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INVESTIGATIONS ON THE PRECOOLING AND TRANSPORTATION (E25.7)

OF FLORIDA CITRUS FRUIT - 1939-40

SUMMARIZED REPORT

1939-40
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By

J. R. Winston, senior horticulturist, E. D. Mallison,
associate horticulturist, and C. O. Bratley, associate
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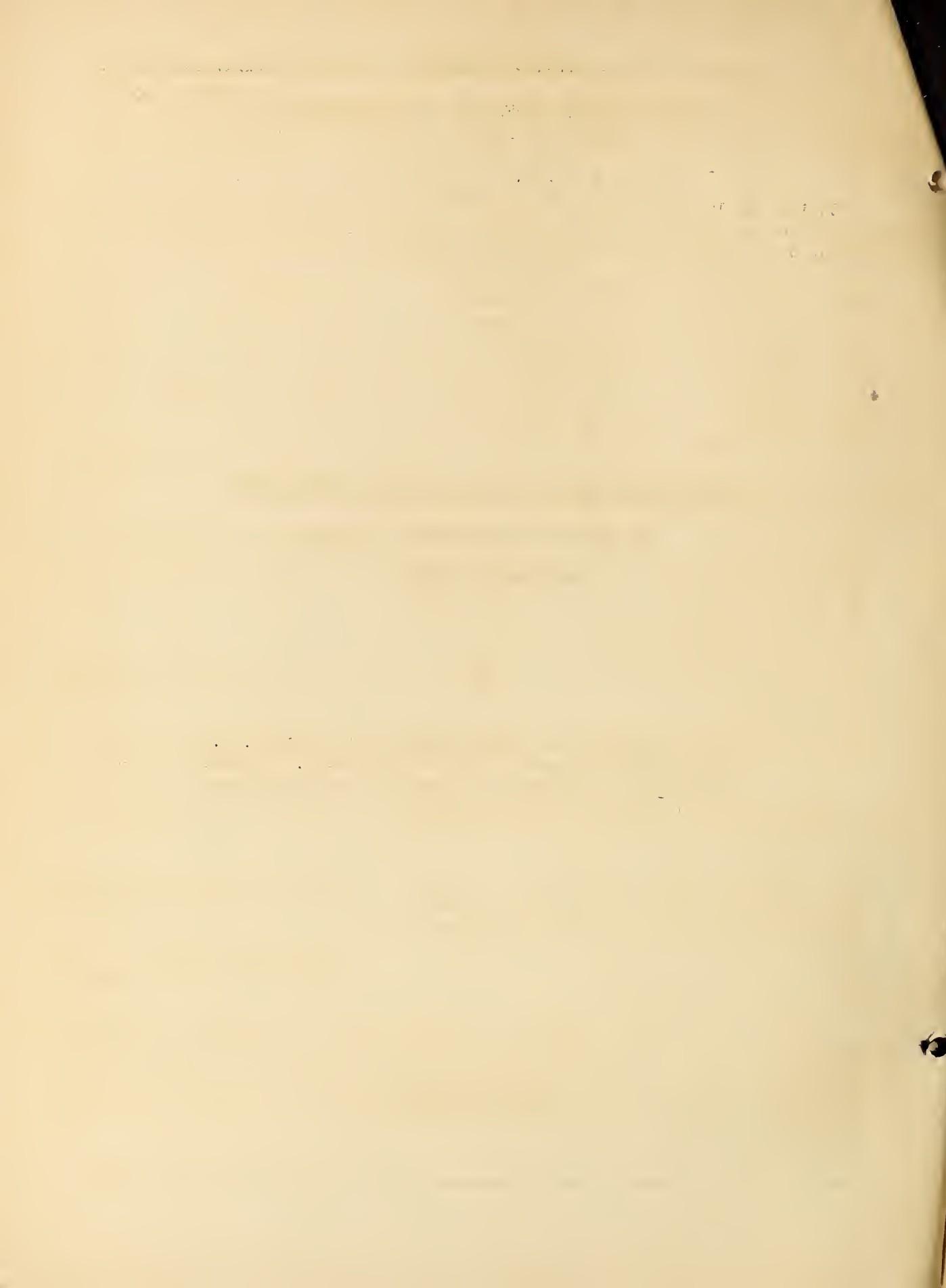
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Washington, D. C.
August 13, 1940



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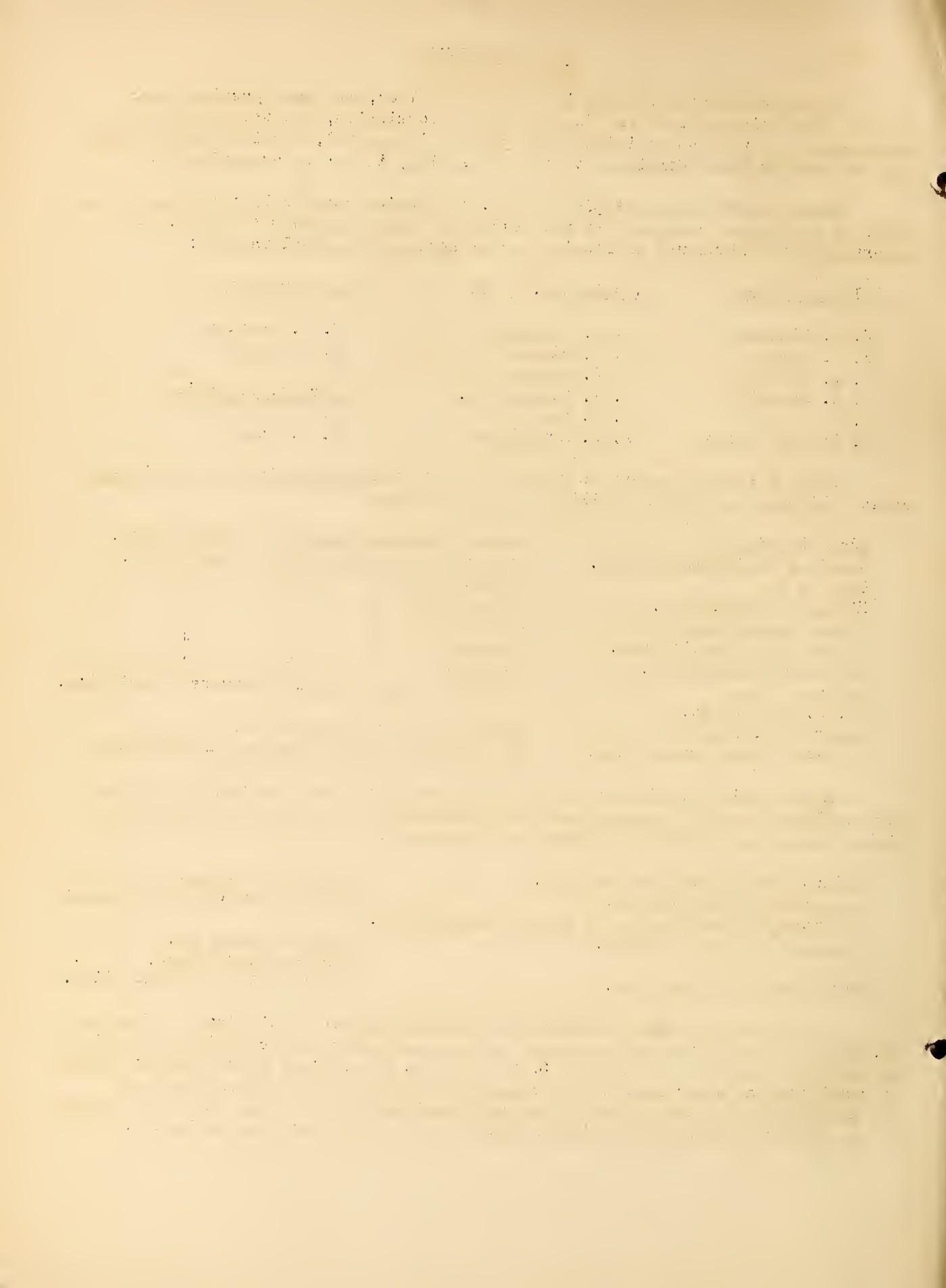


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INVESTIGATIONS ON THE PRECOOLING AND TRANSPORTATION

OF FLORIDA CITRUS FRUIT - 1939-40

SUMMARIZED REPORT

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associate horticulturist, and C. O. Bratley, associate
pathologist. Division of Fruit and Vegetable Crops
and Diseases.

In compliance with a memorandum of understanding entered into between the Florida Citrus Commission and the U. S. Department of Agriculture, transportation studies on citrus fruit were initiated during the season of 1938-39, and a preliminary progress report of the first year's work was issued August 4, 1939. The present report is a brief summary of the past season's work on the same project. This report gives the salient facts developed in the tests, but a detailed consideration of all the data is deferred until it can be incorporated in a Department bulletin after the work is carried to a conclusion. Such a bulletin probably cannot be prepared for several years, since it will be necessary to repeat many of the tests under different conditions before general conclusions can be reached and specific recommendations made.

The work in the 1939-40 season not only continued the tests made in 1938-39 but also included tests on some new types of car equipment to determine how they are suited for the transportation of citrus fruits. The information sought was:

- (1) The relative desirability of the different methods of shipping fruit commonly employed as judged by the condition of the fruit after arrival at destination.
- (2) New methods of shipping which might offer promise of increased efficiency or economy.
- (3) The relative efficiency of refrigerator cars of fundamentally different design, and also those embodying certain changes which could readily be made in the conventional refrigerator car now generally available.

During the season, five rail transportation tests were conducted in which a total of 37 cars were included. They were accompanied by official observers of the Department and by railroad representatives from shipping point to market, and detailed and pertinent information on the condition of the fruit was obtained both at shipping point and at destination. Records on temperature and ice melting were made en route. In this work distance-reading electric resistance thermometers were used to obtain fruit and air temperatures inside the cars without having to open the doors. In addition, six other shipping tests were made

by rail involving 14 cars, and fourteen shipping tests were made by boat, none of which were accompanied. In the shipping tests the transit temperatures were obtained by means of Ryan recording thermometers that were packed in the center of two crates of fruit. One was loaded in the coldest and one in the warmest position in each car, i. e., at the bottom bunker and top doorway. Observations on the condition of the fruit and on the handling of cars at loading point and after arrival at destination were made by official representatives of the Department.

The shipping tests by boat were conducted in the same manner as those by rail, but since it was not feasible to determine where extremes of temperature might exist in the hold only one box of test fruit containing thermometers was utilized in each chamber, and it was allowed to go into the load without special attention as to just where it was placed therein.

Since the cars in which comparisons were made usually originated with different shippers who were moving commercial lots of fruit that were not comparable, and it was necessary to have strictly comparable lots for study after arrival at destination, test fruit was secured especially for the purpose. In each test, therefore, the "test boxes" all came from the same original lot, and all were handled in the same way prior to being placed in the various experiments.

Most of the 1939-40 shipping season was cooler than normal, and due allowance for this should be made in considering the results of the tests.

The freeze of late January came after the investigation had been under way for about 2 months, and caused a temporary interruption in its progress. Low temperatures were so general throughout the citrus-producing sections that for a time most of the fruit on the trees was under suspicion of being injured. When the tests were resumed, after a delay of about 3 weeks, it was difficult to find fruit for use in the test boxes that did not show the effects of freezing. Under these circumstances it was necessary, in all tests made after the freeze, to obtain test fruit from groves where freezing damage was known to have occurred. However, it was thought desirable, whenever possible, to include additional boxes of test fruit from groves where little or no damage from freezing had been found.

All lots of test fruit used on a given date were as nearly as possible of the same grade and size and from the same grove, and packed at the same time. In the transportation tests the test boxes were placed at the top and bottom centerline positions, half way between the bunker and doorway, where the temperatures in an ordinary end-bunker car are believed to approximate the average of the top and bottom layers. In shipping tests the test crates were placed on the centerline at the bottom bunker and top doorway positions, which represent the approximate extremes of temperature found in a carload of fruit.

The cars of nonprecooled fruit that were to be initially iced under Special Refrigeration Service, Item 295, were moved to the icing station with vents open, and the precooled lots were moved with vents closed. At the icing station the cars were iced during the early morning hours following the day of loading. In all cases the vents were closed after icing and remained so until opened for reicing or inspection in transit or at destination.

At time of unloading the test boxes were inspected, decayed fruit was recorded and removed, and the crates were then held without refrigeration (usually at about 70° F.) for about 1 week when a final inspection was made.

Because of the natural variation in keeping quality that exists in any lot of seemingly identical fruit, too much emphasis should not be placed on data obtained from only the few boxes used in each test. However, it is believed that rather than increase the number of test boxes in an attempt to avoid inconsistencies that may be due to size of sample, it is more desirable to repeat the tests a number of times. The latter course seems especially desirable since there are so many possibly varying conditions, some unavoidable, that might influence the results and their proper interpretation.

The results of the present season's tests are presented and discussed under several headings in summarized form only, to show how one type of transit protective service compares with others that might be used during the same part of the season. Detailed records on each car are retained in the files of the Bureau of Plant Industry at Washington, D. C., where they may be consulted if desired.

TRANSPORTATION EQUIPMENT USED IN TESTS

Refrigerator Cars

The conventional type of refrigerator cars with end bunkers used in this investigation were selected so far as possible from the supply of cars normally used in the transportation of Florida citrus fruit. In each test comparable cars were used, selected generally from the same series, so that differences in car construction would not have to be taken into account as one of the possible causes for differences in results. The car equipment was quite uniform; only one of the cars used had less than 2 inches of insulation in the roof and floor, and only two cars had less than 2 inches of insulation in the sides and ends.

The three special refrigerator cars used to study the efficiency of three different methods of refrigeration had 4 inches of insulation in the sides and ends, and 5 inches in the roof and floor. See figure 1 for diagram showing the arrangement of bunkers and loading space. FGE 51377 is a conventional end-bunker car having a bunker capacity of 9,600 pounds of chunk ice. The floor racks are constructed with solid, lengthwise stringers. FGE 50214 is constructed the same as 51677, except

for the bunkers. It is equipped with the Broquinda system of refrigeration, utilizing dry ice to cool a secondary refrigerant which is circulated through coils on the sidewalls just below the ceiling. The dry ice bunkers have a nominal capacity of 5,400 pounds. Floor racks are constructed with notched, lengthwise stringers, and the walls are also equipped with racks. CN 209511 is a steel-sheathed car constructed with 8 bunkers located under the ceiling of the car, having a total capacity of 6,500 pounds of crushed ice. Each tank is equipped with a brine-retaining valve, that was closed during each refrigeration test. The car is so constructed that the cooled air and drip water pass down a metal-lined duct in the sidewall. The floor racks are constructed with crosswise stringers.

Boats

All shipping tests by boat were made in vessels equipped with refrigerated space. The ships of the Bull Steamship Company and the Clyde-Mallory Lines had both refrigerated and nonrefrigerated chambers, while those of the Refrigerated Steamship Line had only refrigerated space.

PRECOOLING OF CITRUS FRUITS

"Precooling" is the rapid cooling of a commodity before shipment, usually after it is packed, to such a temperature as will prolong its normal life expectancy.

Although precooling has been used for many years in Florida for oranges and grapefruit it has not been universally adopted. A number of Florida packing houses are not equipped with precooling facilities and in some cases where these are available they are not used.

Definite standards or specifications for precooling have not yet been established with respect to either temperature requirements or rate of cooling, both of which are important factors in the control of decay. It will be noted in Table I that there was a wide variation in the fruit temperatures taken in various parts of the precooling rooms after precooling was finished. These records were all obtained during the past season and show the range of temperature found in the same room as well as in different rooms in different packinghouses. The results show that the length of time the fruit was precooled was not always the determining factor in the temperatures obtained.

The lack of uniform results in precooling is in some cases due to insufficient refrigerating capacity; in other cases the equipment is not operated efficiently, but in many cases the fruit is not left in the precooling room long enough for it to come to a uniform temperature, and may not be stacked so as to facilitate rapid cooling.

It is not uncommon to find a range of 20° or more in so-called precooled fruit at time of loading yet a range of only 2° or 3° is sometimes found when thorough and careful attention is given to the operation of precooling rooms.

With such a wide variation in precooling practices it is to be expected that similar widely varying effects on the fruit would be noted so far as decay control is concerned. It is possible that insufficient precooling of Florida citrus fruit and the subsequent lack of beneficial results may have led some shippers to believe precooling is an unnecessary expense without benefit. Another fact contributing to such an opinion is that at time of arrival at destination the appearance and condition of nonprecooled oranges is quite like that of well-precooled oranges. This was found to be generally true in the shipping tests of the present season. It was found that marked difference became apparent only after holding the precooled and nonprecooled lots for a few days at temperatures comparable to those found in stores. Well-precooled oranges held up much better with less decay for a longer time than comparable non-precooled fruits, consequently one might easily be misled if he were to judge precooling solely by the condition of the fruit upon arrival at market. Confidence in the holding quality of the fruit is a factor that must influence the market demand for it and the price which it will bring. It cannot be based altogether upon conditions found on arrival.

The fungi which cause decay in citrus fruits develop quite slowly at temperatures below 50°F. It is therefore recommended that the fruit be precooled to 40° or below within 24 hours after packing. It should then be shipped under the most economical service that will prevent fruit temperatures from rising above 50° during the transit period. During warm weather, especially late in the shipping season when the fruit is well advanced in maturity, there is the greatest need for low temperatures both during precooling and in transit. This is especially true in the case of gassed fruit, which frequently is rendered more susceptible to decay by the gassing treatment.

Table I. - Precooling of citrus fruits. Fruit temperatures determined with mercury thermometers in various precooling rooms. 1939-40.

Length of Precooling <u>Hours</u>	Number of Readings Per Room	Range °F	Average °F
8	16	30 - 42	35
7	10	32 - 40	36
7	10	34 - 45	38.5
24	20	29 - 48	40.4
50	16	36 - 43	37.5
50	17	36 - 46	40
2 days	10	32.5 - 34	33.4
42	41	31 - 45	39
18	37	34 - 52	44
456 boxes - 60)			
300. " - 18)	52	32 - 50	41.1
10	20	39 - 52	42.8
6	18	43 - 54	45.8
9	12	37 - 50	43.0
Part - 24)			
Part - 48)	10	32 - 40	37.8
24	10	34 - 43	37.5
Gradually built up) for several days)	10	29 - 45	35.0
27	10	41 - 45	43.7
300 boxes - 60)			
120 " - 36)	10	37 - 46	42
300 boxes - 36)			
120 " - 20)	10	44 - 66	54
12	10	31 - 36	33.4
3-1/4	10	38 - 58	50.6
98	10	34 - 55	47.5
24	12	35 - 36	35.5
		55.4 - 54	40.6

COMPARISON OF NONPRECOOLED ORANGES SHIPPED UNDER
STANDARD VENTILATION AND SIMILAR FRUIT
SHIPPED WITH INITIAL ICING (ITEM 295)

Under standard ventilation, changes in commodity temperature are due largely to the temperature of the outside air forced through the load. Since air temperature varies not only from day to night but from day to day with changing weather conditions, the results obtainable from standard ventilation are variable and inconclusive. The value of the service can never be accurately anticipated. However, a great many cars of oranges and grapefruit are shipped under standard ventilation. Initial icing (under Rule 240 and Item 295) is the most commonly utilized refrigeration service in the transportation of Florida oranges.

During the season five tests were made in which standard ventilation was compared with initial icing (Rule 240 or Item 295). During the winter and early spring the bottom layer of fruit generally reached lower temperatures in the iced cars than in the ventilated cars, but the difference in temperature of fruit in the top layers was not great. The slight differences noted in transit temperatures had little, if any, effect on the development of decay in the tests made in colder weather, i.e., in January, March, and early April. However, in those made in late April and May, decay developed more rapidly and to a greater extent in the lots shipped under standard ventilation than in those under refrigeration.

Commodity: Pineapple oranges

(Loaded January 25, 1940
Date(

Load: 400 standard boxes

(Unloaded January 29, 1940

Loading point: Orlando, Fla. Destination: New York, N.Y. CAR NO. FGE 50087

Service: Non precooled standard ventilation

Vents opened from Orlando to Sanford and from Jacksonville to Savannah

Ice remaining at:

FRUIT TEMPERATURESAt time of loading:

Range 44° to 51°

Average 47.1 °F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	46.5	39.5
Bunker-centerline	44.5	59.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlongth</u>	<u>Bottom Quarterlongth</u>
<u>At time of loading</u>	98.0	98.0
<u>When unloaded</u>	97.8	97.2
<u>Loss of Weight</u>	.2 lb.	.8 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>		After holding 7 days at 65° F.; 47% relative humidity	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	7	5	42	41
Aging	0	0	3	2
Withered at stem end	0	0	5	3
Stem-end rot	0	0	0	0
Penicillium rot	0	0	8	2

TEST NO. 1940-1

Commodity: Pineapple oranges

(Loaded January 25, 1940

Load: 400 standard boxes

Date(

(Unloaded January 29, 1940

Loading point: Kaitland, Fla. Destination: New York, N. Y. CAR NO. FGE 36364

Service: Initially iced with 6000 lbs. of ice after loading (Item 295). Ice removed at Potowac Yards 2 heaters installed and lighted.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 43° to 50°

Average 46° °F.

Upon arrival:

Doorway-centerline

Top layer
46.5

Bottom layer
40

Bunker-centerline

48.0

39.5

WEIGHT OF TEST CRATES

At time of loading

98.0

100.6

When unloaded

98.0

Loss of weight

0

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 7 days at 65° F.;
47% relative humidity

Stems Fresh and green
General condition of fruit firm

Fairly fresh and green
Generally firm; several fairly
firm few withered.

Top Ql. Bot. Ql.

Top Ql. Bot. Ql.

Total fruits in test crate	176	176	-----	-----
Pitting	14	10	50	47
Aging	0	0	3	0
Withered at stem end	0	0	8	3
Stem-end rot	0	0	0	0
Pemicillium rot	0	0	11	6

Commodity: Valencia Oranges* (Loaded March 28, 1940
Load: 420 Bruce boxes Date (Unloaded April 1, 1940
Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 37223
Service: Standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 78° to 30° Average 79.5 °F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	59.5	56.0
Bunker-centerline	58.5	57.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.5	93.5
<u>When unloaded</u>	93.4	92.3
<u>Loss of weight</u>	2.1 lbs.	1.2 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F. 60% relative humidity	
		<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Green fresh		Fresh green
General condition of fruit	Fairly firm		Some withered
Total fruits in test crate	176	176	-----
Pitting	1	0	0
Aging	0	0	0
Withered at stem end	0	0	5
Stem-end rot	0	0	4
Penicillium rot	0	0	0

* From frost damaged grove

TEST NO. 1940-2

Commodity: Valencia Oranges* (Loaded March 28, 1940
Load: 402 standard boxes Date (Unloaded April 2, 1940
Loading point: Lake Wales, Fla. Destination: New York, N.Y. CAR NO. FGE 37102
Service: Non precooled, 6000 lbs. ice after loading, plugs in vents closed to destination.

Ice remaining at: Hamlet 3400 lbs. at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 74° Average 72° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	64.5	54.0
Bunker-centerline	65.0	50.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	97.8	98.0
<u>When unloaded</u>	96.3	96.4
<u>Loss of weight</u>	1.5 lbs.	1.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F. 60% relative humidity	
Stems	Green fresh	Half green half gray	
General condition of fruit	Firm to fairly firm	Mostly firm many slightly soft	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	5	8	5
Aging	13	18	31
Withered at stem end	12	16	14
Stem-end rot	0	0	37
Penicillium rot	9	5	29
			46

* Frostfree fruit

TMST WO 1940-2

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 404 Bruce boxes Date (Unloaded April 15, 1940
Loading point: Lucerne Park, Destination: Washington, D.C. CAR NO. FGE 36200
Fla.
Service: Standard ventilation

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 70° to 73° Average 71.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	51.5	53.5
Bunker-centerline	46.5	42.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	103.5	106.0
<u>When unloaded</u>	<u>102.5</u>	<u>105.3</u>
<u>Loss of weight</u>	1.0 lbs.	0.7 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity	
Stems	Fresh green	Mostly dry slightly moldy	
General condition of fruit	Slightly soft	Soft	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	3	0	1
Aging	0	0	0
Withered at stem end	0	0	6
Stem-end rot	0	0	65
Penicillium rot	1	0	6
* Frost free fruit			56
			3
			TEST NO. 1940-3

* Frost free fruit

TEST NO. 1940-3

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 404 Bruce boxes

Date(

(Unloaded April 15, 1940

Loading point: Lucerne Park, Destination: Wash., D. C. CAR NO. FGE 36200
Florida

Service: Standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 70° to 73°

Average 71.1 °F.

Upon arrival:

	Top layer	Bottom layer
Doorway-centerline	51.5	53.5
Bunker-centerline	46.5	42.5

WEIGHT OF TEST CRATES

	Top Quarterlength	Bottom Quarterlength
<u>At time of loading</u>	96.5	96.2
<u>When unloaded</u>	95.2	95.1
<u>Loss of weight</u>	1.3 lbs.	1.1 lbs.

SUMMARY OF INSPECTION NOTES

	When unloaded	After holding 10 days at 69° F.; 65% relative humidity
--	---------------	-----------------------------------------------------------

Stems	Fresh green	Dry, green
General condition of fruit	Slightly soft	Soft

	Top Ql.	Bot. Ql.	Top Ql.	Bot. Ql.
Total fruits in test crate	176	176	-----	-----
Pitting	0	0	0	0
Aging	0	0	0	0
Withered at stem end	0	1	20	14
Stem-end rot	0	0	58	59
Penicillium rot	1	0	2	5

*From frost damaged grove

TEST NO. 1940-3

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

Load: 400 Bruce boxes

(Unloaded April 15, 1940

Loading point: Lucerne Park, Destination: Baltimore, Md CAR NO. FGE 51337
Fla.

Service: Non precooled, initially iced with 8000 lbs. of ice after loading
(Item 295) plugs in vents closed to Potomac Yards.

Ice remaining at: Potomac Yards 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 77° Average 73.1 °F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	49.0	40.0
Bunker-centerline	49.5	35.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	95.5	98.5
When unloaded	93.7	97.4
Loss of weight	1.8 lbs.	1.1 lbs.

SUMMARY OF INSPECTION NOTES

<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green
General condition of fruit	Firm

	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	0	0	0	0
Aging	0	0	0	0
Withered at stem end	2	0	21	12
Stem-end rot	0	0	59	44
Penicillium rot	2	0	7	1

* From frost damaged grove

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 400 Bruce boxes

Date(

(Unloaded April 15, 1940

Loading point: Lucerne Park, Destination: Baltimore, Md. CAR NO. FGE 51337
Fla.

Service: Non precooled, initially iced with 8000 lbs. of ice after loading
(Item 295) plugs in vents closed to Potomac Yards.

Ice remaining at: Potomac Yards 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 77°

Average 73.1 °F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	49.0	40.0
Bunker-centerline	49.5	35.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	105.5	104.0
<u>When unloaded</u>	104.6	103.6
<u>Loss of weight</u>	0.9 lb.	0.4 lb.

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 10 days at 69° F.;
65% relative humidity

Stems Fresh green
General condition of fruit Fairly firm

Mostly dry, slightly moldy.
Fairly firm, few soft

Top Ql. Bot. Ql.

Top Ql. Bot. Ql.

Total fruits in test crate	176	176	-----	-----
Pitting	0	1	0	0
Aging	0	0	0	0
Withered at stem end	0	0	11	9
Stem-end rot	0	0	71	71
Penicillium rot	0	0	2	2

* Frost free fruit

TEST NO. 1940-3

Commodity: Valencia oranges* (Loaded April 27, 1940
Date:
Load: 402 Bruce boxes (Unloaded May 3, 1940
Loading point: Lucerne Pk. Fla. Destination: Washington, CAR NO. WFE 63377
D.C.
Service: Non precooled, standard ventilation

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 71° to 77° Average 73.7°F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	62°	-----
Bunker-centerline	-----	61°

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	96.5	95.2
<u>When unloaded</u>	95.4	93.8
<u>Loss of weight</u>	1.1 lbs.	1.4 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 7 days at 70° F.; 85% relative humidity</u>
Stems	Green and fresh	Mostly dry and green
General condition of fruit	Good	Good.

	<u>Top dry.</u>	<u>Bot. bunk.</u>		<u>Top dry.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	174	174	-----	-----	-----
Pitting	0	0	0	0	0
Aging	0	0	0	0	0
Withered at stem end	0	0	8	8	8
Stem-end rot	0	0	43	21	21
Penicillium rot	2	0	2	3	3

* From frost damaged grove.

Commodity: Valencia oranges*

(Loaded May 4, 1940

Load: 402 Bruce boxes

Date(

(Unloaded May 8, 1940

Loading point: Lucerne Pk. Fla. Destination: Washington, CAR NO. FGE 33962
D. C.

Service: Non precooled, standard ventilation

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 65° to 82° Average 71.6° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	67°	52°
Bunker-centerline	65°	56°

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of packing 1/</u>	96.2	93.2
<u>When unloaded</u>	93.1	89.3
Loss of weight	3.1 lbs.	3.9 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 7 days at 70° F.; 87% relative humidity</u>		
	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Stems	Green but dry	Green but dry		
General condition of fruit	Good	Wilted and aged		
Total fruits in test crate	174	173	-----	-----
Pitting	1	2	6	1
Aging	3	0	2	4
Withered at stem end	25	64	34	82
Stem-end rot	1	0	30	25
Penicillium rot	2	1	2	3

* From frost damaged grove.

1/Packed May 5, 1940.

TEST NO. 1940-RS-3

Commodity: Valencia oranges*

(Loaded May 4, 1940

Load: 402 Bruce boxes

Date(

(Unloaded May 8, 1940

Loading point: Lucerne Pk. Fla. Destination: Baltimore, Md. CAR NO. FGE 15167

Service: Non precooled, initially iced with 8000 lbs. ice. vents closed to destination.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 65° to 70°

Average 66.8° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	58-62	-----
Bunker-centerline	-----	47-58

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of packing</u>	94.3	95.4
<u>When unloaded</u>	92.3	94.4
<u>Loss of weight</u>	2.0 lbs.	1.0 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 70° F.; 85% relative humidity	
		<u>Top doorway</u>	<u>Bot. bunk.</u>
Stems	Fresh and green		Green but dry
General condition of fruit	Good		Good except for wilting
	<u>Top doorway</u>	<u>Bot. bunk.</u>	<u>Top doorway</u>
Total fruits in test crate	173	173	-----
Pitting	0	0	2
Aging	0	0	0
Withered at stem end	0	0	38
Stem-end rot	0	0	16
Penicillium	2	1	4

* From frost damaged grove.

TEST NO. 1940-RS-5

COMPARISON OF RESULTS WITH NONPRECOOLED FRUIT SHIPPED UNDER STANDARD
VENTILATION WITH PRECOOLED AND NONPRECOOLED FRUIT
SHIPPED UNDER REFRIGERATION

In these tests nonprecooled oranges shipped under ventilation were compared with precooled and nonprecooled oranges shipped under Item 295. Some lots were precooled in the car by platform precoolers and others were precooled in regular precooling rooms. Under Item 295, 8,000 pounds of ice was added at the first icing station after loading. Fruit temperatures during transit were highest in the car under standard ventilation. In the iced shipments the temperatures in transit were lowest in the car loaded with room-precooled fruit, slightly higher in the car containing the platform-precooled fruit, and highest in the car containing the nonprecooled load.

There was little if any difference in appearance of the several test lots on arrival at market, but a week later much more decay had developed in the nonprecooled fruit shipped under ventilation than in any of the precooled lots or the nonprecooled lot shipped under refrigeration. In this connection it is worthy of note that the rate of decay both during transit and after the holding period was greater in the top-layer boxes than in those from the bottom layer. This difference doubtless was due largely to the difference in temperature in transit at the two positions. With weak fruit and under adverse weather conditions this is further evidence that it is desirable to maintain low transit temperatures to reduce decay and increase the confidence of buyers in the likelihood of the fruit standing up well during the ordinary marketing period.

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date _____

(Unloaded April 15, 1940

Load: 404 Bruce boxes

Loading point: Lucerne Park, Destination: Wash., D. C. CAR NO. FGE 36200
Florida

Service: Non precooled standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 70° to 73°

Average 71.1 °F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	51.5	53.5
Bunker-centerline	46.5	42.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	96.2
<u>When unloaded</u>	95.2	95.1
<u>Loss of weight</u>	1.3 lbs.	1.1 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity	
Stems	Fresh green	Dry, green	
General condition of fruit	Slightly soft	Soft	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	
Total fruits in test crate	176	176	-----
Pitting	0	0	0
Aging	0	0	0
Withered at stem end	0	1	20
Stem-end rot	0	0	53
Penicillium rot	1	0	2
			5

*From frost damaged grove

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 404 Bruce boxes Date (Unloaded April 15, 1940
Loading point: Lucerne Park, Destination: Washington, CAP NO. FGE 36200
Fla. D. C.
Service: Non precooled standard ventilation

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 70° to 73° Average 71.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	51.5	53.5
Bunker-centerline	46.5	42.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	103.5	106.0
<u>When unloaded</u>	102.5	105.3
<u>Loss of weight</u>	1.0 lb.	0.7 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	3	0
Aging	0	0
Withered at stem end	0	6
Stem-end rot	0	65
Penicillium rot	1	56
		3

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 420 Bruce boxes Date (Unloaded April 15, 1940
Loading point: Lake Alfred, Fla. Destination: New York, N.Y. CAR NO. FGE 50543
Service: Non precooled, initially iced with 8000 lbs. of ice after loading
(Item 295) plugs in vents closed to South Rocky Mount, open beyond.

Ice remaining at: Potomac Yards 1400 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 72° to 84° Average 79° F.

Upon arrival:

	Top layer	Bottom layer
Doorway-centerline	50.0	37.0
Bunker-centerline	44.0	34.5

WEIGHT OF TEST CRATES

	Top Quarterlength	Bottom Quarterlength
At time of loading	96.5	97.0
When unloaded	94.3	95.2
Loss of weight	2.2 lbs.	1.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69 F.; 65% relative humidity
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	0	0
Aging	0	5
Withered at stem end	0	27
Stem-end rot	0	34
Penicillium rot	2	5

* From frost damaged grove

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

Load: 420 Bruce boxes

(Unloaded April 15, 1940

Loading point: Haines City Destination: New York, N.Y. CAR NO. FGE 50623
Fla.

Service: Precooled with platform precooler, initially iced with 2000 lbs. of
ice after loading (Item 295) plugs in vents closed to destination.

Ice remaining at: Potomac Yards 3500 lbs. At destination 2000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 69° to 71°

Average 70° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.5	40.0
Bunker-centerline	50.0	36.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.8	96.0
<u>When unloaded</u>	94.1	94.0
<u>Loss of weight</u>	2.7 lbs.	2.0 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	1
Withered at stem end	1	3
Stem-end rot	0	19
Penicillium rot	0	2
	<u>Top Ql.</u>	<u>Bot. Ql.</u>

* From frost damaged grove

Commodity: Valencia Oranges*

(Loaded April 11, 1940

Date:

(Unloaded April 15, 1940

Load: 420 Bruce boxes

Loading point: Haines City, Fla. Destination: New York, N.Y. CAR NO. FGE 50623

Service: Precooled with platform precooler, initially iced with 8000 lbs. of ice after loading (Item 295) plugs in vents closed to destination.

Ice remaining at: Potomac Yards 3500 lbs. At destination 2000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 69° to 71°

Average 70° E.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.5	40.0
Bunker-centerline	50.0	36.5

WEIGHT OF TEST CRATES

<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
105.5	103.4
<u>103.3</u>	<u>101.3</u>
2.2 lbs.	2.1 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 10 days at 69° F., 65% relative humidity</u>
Stems	Fresh green	Mostly fresh green
General condition of fruit	Mostly firm	Fairly firm, few slightly soft
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	0
Withered at stem end	0	1
Stem-end rot	0	0
Penicillium rot	1	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
	----	----
	3	1
	1	1
	3	0
	35	28
	6	4

COMPARISON OF NONPRECOOLED ORANGES SHIPPED UNDER
STANDARD VENTILATION AND PRECOOLED ORANGES
SHIPPED PLUGS IN, VENTS CLOSED

Shippers are in general agreement that standard ventilation is undesirable for Florida oranges and grapefruit in hot weather, but some shippers think this service is satisfactory during the cooler months. Three tests were made during the 1939-40 shipping season in which comparisons were made between nonprecooled fruit shipped under ventilation and precooled fruit shipped without transit refrigeration in cars with vents closed, plugs in. The first test was in December, the second in January, and the third in March.

The first test was made in moderately mild weather. Fruit temperatures in transit were considerably lower in the precooled car, especially during the first day or two. No decay was observed in either car on arrival, but a week later about twice as much decay had developed in the nonprecooled fruit as in the precooled.

The second test was conducted in January during very cold weather. The fruit in the nonprecooled car was for the most part below 50° at time of loading, and it continued to cool throughout the transit period. The precooled fruit was considerably cooler at loading time, and it too cooled in transit. No decay was observed in either lot at time of unloading. After holding for 1 week penicillium rot was the only kind of decay found, and it was somewhat more extensive in the precooled fruit. However, considering the nature of this rot and that it almost always follows mechanical injury the difference between the two lots of fruit could hardly be caused by transit temperatures.

The third test was made in late March. In the precooled car the temperature of the top fruit did not rise above 50° F.; while in the standard-vent car it did not fall to 50° at any time. This difference in transit temperature was reflected in the amount of decay that developed. There was only a trace of decay in the precooled lot at time of unloading, but in the warm fruit there was considerably more. The superiority of the precooled fruit was maintained throughout the 7-day holding period thereafter, during which the two lots were kept under observation.

The results of these tests give further indication of the advantages in precooling oranges even in winter.

Commodity: Pineapple oranges (Loaded Dec. 13, 1939
Load: 420 Bruce boxes Date (Unloaded Dec. 17, 1939
Loading point: Tildenville, Destination: Chicago, Ill. CAR NO. FGE 51367
Service: Non precooled; standard ventilation

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 65° to 73° Average 69° F.

Upon arrival:

	Top layer	Bottom layer
Doorway-center line	54°	44.5°
Bunker-centerline	47°	41.5°

WEIGHT OF TEST CRATES

	Top Quarterlength	Bottom Quarterlength
At time of loading	94.3	92.3
When unloaded	91.5	90.0
Loss of weight	2.8 lbs.	2.3 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 8 days at 71° F.; 40% relative humidity</u>
Total fruits in test crate	Top Ql. Bot. Ql.	Top Ql. Bot. Ql.
Stems	Dark and withered	Dark and withered
General condition of fruit	Fairly soft	Noticeably soft
Pitting	32	29
Aging	8	6
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0

Commodity: Pineapple oranges (Loaded Dec. 13, 1939
Date(Load: 420 Bruce boxes (Unloaded Dec. 17, 1939
Loading point: Plymouth, Fla. Destination: Chicago, Ill. CAR NO. FGE 37792
Service: Precooled, no ice in bunkers, vents closed to destination.

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 30° to 42° Average 35° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	47.5	41.0
Bunker-centerline	44.5	41.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of packing</u>	94.0	96.0
<u>When unloaded</u>	94	95.2
Loss of weight	0.0 lbs.	0.8 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 8 days at 71° F.; 40% relative humidity
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Dark and withered	Dark and withered
General condition of fruit	Firm	Only slight softening during storage.
Total fruits in test crate	216	-----
Pitting	13	16
Aging	0	0
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0

Commodity: Pineapple oranges (Loaded January 25, 1940
Date:
Load: 400 standard boxes (Unloaded January 29, 1940

Loading point: Orlando, Fla. Destination: New York, N.Y. CAR NO. EGE 50087

Service: Non precooled standard ventilation.

Vents opened from Orlando to Sanford and from Jacksonville to Savannah

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 44° to 51° Average 47.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-center line	46.5	39.5
Bunker-centerline	44.5	39.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	98.0	98.0
<u>Loss of weight</u>	97.8	97.2
<u>Loss of weight</u>	.2 lb.	.8 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 65° F., 47% relative humidity	
Stems	Green--fresh	Fairly green--fresh	
General condition of fruit	Firm	Generally firm several fairly firm--occasionally withered.	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	
Total fruits in test crate	176	176	-----
Pitting	7	5	42
Aging	0	0	3
Withered at stem end	0	0	5
Stem-end rot	0	0	0
Penicillium rot	0	0	2

Commodity: Pineapple oranges (Loaded January 25, 1940)
Load: 400-1/2 standard boxes Date (Unloaded January 29, 1940)
Loading point: Isleworth, Fl. Destination: New York, N.Y. CAR NO. FGE 37705
Service: Precooled, no ice in bunkers, vents closed to destination.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 29° to 48° Average 40.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	39.5	35.5
Bunker-centerline	39.5	37.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	No weight in Fla.	No weight in Fla.
<u>When unloaded</u>	101.6	98.8
<u>Loss of weight</u>		

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 7 days at 65° F.; 47% relative humidity</u>
Stems	Green--fresh	Fairly fresh--green
General condition of fruit	Firm	Generally firm, several fairly firm; occasionally withered.
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	10	8
Aging	0	1
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
	-----	-----
	41	46
	5	1
	5	3
	0	0
	11	7

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Date(

(Unloaded April 1, 1940

Load: 420 Bruce boxes

Loading point: Auburndale, Fl. Destination: New York, N.Y. CAR NO. FGE 37223

Service: Standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 78° to 80°

Average 79.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	59.5	56.0
Bunker-centerline	58.5	57.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.5	93.5
<u>When unloaded</u>	93.4	92.3
<u>Loss of weight</u>	2.1 lbs.	1.2 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Green fresh	Fresh green
General condition of fruit	Fairly firm	Some withered
Total fruits in test crate	176	176
Pitting	1	0
Aging	0	0
Withered at stem end	0	3
Stem-end rot	0	4
Penicillium rot	0	0

* From frost damaged grove

TEST NO. 1940-2

Commodity: Valencia Oranges* (Loaded March 28, 1940
Load: 420 Bruce boxes Date((Unloaded April 1, 1940
Loading point: Auburndale, Fl. Destination: New York, N.Y. CAR NO. FGE 37223
Service: Standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 78° to 80° Average 79.5° F.

Upon arrival:

	Top layer	Bottom layer
Doorway-centerline	59.5	56.0
Bunker-centerline	58.5	57.0

WEIGHT OF TEST CRATES

	Top Quarterlength	Bottom Quarterlength
<u>At time of loading</u>	99.0	95.2
<u>When unloaded</u>	97.4	93.5
<u>Loss of weight</u>	1.6 lbs.	1.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green and fresh	Half gray, half green
General condition of fruit	Some badly wilted	Some badly wilted

	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	----	----
Pitting	8	16	5	2
Aging	22	8	19	25
Withered at stem end	32	6	18	30
Stem-end rot	2	0	42	30
Penicillium rot	11	1	42	16

Commodity: Valencia oranges*

(Loaded March 28, 1940

Date(

(Unloaded April 1, 1940

Load: 404 standard boxes

Loading point: Plymouth, Fla. Destination: New York, N.Y. CAR NO. FGE 37138

Service: Precooled, no ice in bunkers, plugs in vents closed to destination

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 32.5° to 34° Average 33.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	44.0
Bunker-centerline	50.5	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	95.2
<u>When unloaded</u>	95.8	94.5
<u>Loss of weight</u>	0.7 lb.	0.7 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity	
		<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Green fresh		
General condition of fruit	Firm		
Total fruits in test crate	176	176	-----
Pitting	0	0	0
Aging	0	0	0
Withered at stem end	0	0	6
Stem-end rot	0	0	0
Panicillium rot	0	0	0

* From frost damaged grove

TEST NO. 1940-2

Commodity: Valencia Oranges* (Loaded March 28, 1940
Date:
Load: 404 standard boxes (Unloaded April 1, 1940
Loading point: Plymouth, Fla. Destination: New York, N.Y. CAR NO. FGE 37138
Service: Precooled, no ice in bunkers, plugs in vents closed to destination

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 32.5° to 34° Average 33.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	44.0
Bunker-centerline	50.5	44.0

WEIGHT OF TEST CUPATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	98.0	97.8
<u>When unloaded</u>	97.3	97.2
<u>Loss of weight</u>	0.7 lb.	0.6 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 10 days at 70° F.; 60% relative humidity</u>
Stems	Green fresh	Half green, half gray
General condition of fruit several frost free lots	Freshest of the	Freshest of the several frost free lots
	.	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	3	6
Aging	0	0
Withered at stem end	0	0
Stem-end rot	2	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
	-----	-----
	3	2
	11	16
	15	29
	20	2
	14	15

* Frost free fruit

COMPARISON OF RESULTS IN CARS OF CITRUS FRUIT SHIPPED UNDER STANDARD VENTILATION
AND OVERHEAD VENTILATION.

Overhead ventilation differs from standard ventilation in that all of the air is directed over the top of the load through the top bunker openings instead of entering the loading space through both top and bottom bunker openings as in standard ventilation.

Since overhead ventilation has proved to be quite satisfactory for transcontinental shipments of citrus fruit from California during the colder months of the year, it seemed worthy of trial for shipments from Florida.

Three tests were made in November and December, 1939.

In cars shipped under the two methods the temperature difference was not great at the top doorway, but under standard ventilation the fruit at the bottom bunker cooled more rapidly, as shown in the following table.

Average Fruit Temperatures in Transit

Date of test	Top doorway		Bottom bunker	
	Standard ventilation	Overhead ventilation	Standard ventilation	Overhead ventilation
Nov. 21, 1939	°F.	°F.	°F.	°F.
63.5	62.3	55.3	62.2	
Dec. 5, 1939	65.7	69.3	51.7	64.0
Dec. 13, 1939	58.2	60.6	45.6	49.4

Little or no difference in the amount of decay was noted at time of unloading, but in each test one week after arrival there was considerably more decay in the test fruit from the cars under overhead ventilation. Under Florida conditions even in cool weather, therefore, it is believed that standard ventilation is preferable to overhead ventilation.

Commodity: Parson Brown oranges, gassed & color added (Loaded November 21, 1939

Load: 420 Bruce boxes Date (Unloaded November 25, 1939

Loading point: Tildenville, Destination: Chicago, Ill. CAR NO. FGE 33361
Florida

Service: Non precooled, standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 79° to 83° Average 85.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	48	38
Bunker-centerline	43	38

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	101.5	101.5
<u>When unloaded</u>	99.5	99.7
<u>Loss of weight</u>	2.0 lbs.	1.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 71° F.; 54% relative humidity
Stems	Dark and withered	Dark and withered
General condition of fruit	Firm to fairly firm	Firm to fairly firm
	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	216	216
Pitting	33	22
Aging	0	0
Withered at stem end	0	0
Stem-end rot	2	0
Penicillium rot	0	0

Commodity: Parson Brown oranges, gassed & color added. (Loaded November 21, 1939
Load: 420 Bruce boxes Date (Unloaded November 25, 1939

Loading point: Tildenville, Florida Destination: New York, N.Y. CAR NO. FGE 32023

Service: Non precooled; Overhead ventilation.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 78° to 83° Average 80.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	44	40
Bunker-centerline	43	41

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	101.5	101.5
<u>When unloaded</u>	99.7	99.5
<u>Loss of weight</u>	1.7 lb.	2.0 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 71° F.; 54% relative humidity	
Stems	Dark and withered	Dark and withered	
General condition of fruit	Firm to fairly firm	Firm to fairly firm	
	<u>Top doorway</u>	<u>Bot. Bunk.</u>	<u>Top doorway</u>
Total fruits in test crate	216	216	-----
Pitting	63	50	74
Aging	1	1	8
Withered at stem end	0	0	0
Stem-end rot	1	1	19
Penicillium rot	1	0	2

Commodity: Pineapple oranges, gassed

(Loaded December 5, 1939

Load: 402 standard boxes

Date(

(Unloaded December 8, 1939

Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. MFE 61482

Service: Non precooled; overhead ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 73° to 76°

Average 74.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	56	54
Bunker-centerline	60	56

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	102.0	102.0
<u>When unloaded</u>	101.2	101.0
<u>Loss of weight</u>	.7 lb.	1.0 lb.

SUMMARY OF INSPECTION NOTES

	<u>Top doorway</u>	<u>Bot. bunker</u>		<u>Top doorway</u>	<u>Bot. bunker</u>
Stems	Mostly gray and wilted		After holding 7 days at 67° F.; 48% relative humidity		
General condition of fruit	Firm				
Total fruits in test crate	168	167		-----	-----
Pitting	6	2		12	14
Aging	0	0		2	1
Withered at stem end	0	1		5	8
Stem-end rot	0	0		6	8
Penicillium rot	0	0		0	0

Commodity: Pineapple oranges, gassed (Loaded December 5, 1939
Date (Load: 402 standard boxes (Unloaded December 8, 1939
Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 15890
Service: Non precooled, standard ventilation

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 71° to 73.5° Average 72.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	55	51
Bunker-centerline	56	50

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
At time of loading	99.0	101.0
When unloaded	99.25	98.6
Loss of weight	.25 lb. (gain)	2.4 lb.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 67° F.: 48% relative humidity
Stems	Mostly gray and withered	Dark and dry
General condition of fruit	Firm	Firm
	<u>Top doorway.</u>	<u>Bot. bunker.</u>
Total fruits in test crate	168	169
Pitting	3	5
Aging	0	0
Withered at stem end	1	0
Stem-end rot	0	0
Penicillium rot	0	0

Commodity: Pineapple oranges

(Loaded Dec. 13, 1939

Load: 420 Bruce boxes

Date(

(Unloaded Dec. 17, 1939

Loading point: Wildenville, Florida Destination: Chicago, Ill. CAR HO. FGE 51367

Service: Non precooled; standard ventilation

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 65° to 73°

Average 69° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	54°	44.5°
Bunker-centerline	47°	41.5°

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.3	92.3
<u>When unloaded</u>	91.5	90.0
<u>Loss of weight</u>	2.8 lbs.	2.3 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 3 days at 71° F.; 40% relative humidity
Stems	Dark and withered	Dark and withered
General condition of fruit	Fairly soft	Noticeably soft
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216
Pitting	32	29
Aging	8	6
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0

TEST NO. 1939-2

Commodity: Pineapple oranges Loaded Dec. 13, 1939
Load: 420 Bruce boxes Date (Unloaded Dec. 17, 1939)
Loading point: Tildenville, Florida Destination: Chicago, Ill. CAR NO. FGE 50738
Service: Non precooled; controlled ventilation (overhead)

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 65° to 69° Average 68° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	56.5	55.0
Bunker-centerline	54.5	52.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	92.0	92.5
<u>When unloaded</u>	90	90
<u>Loss of weight</u>	2.0 lbs.	2.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>		After holding 8 days at 71° F. 40% relative humidity	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216	-----	-----
Pitting	21	16	29	27
Aging	2	2	15	6
Withered at stem end	0	0	0	0
Stem-end rot	2	0	59	64
Penicillium rot	0	0	0	1

TEST NO. 1939-2

COMPARISON OF RESULTS WITH NONPRECOOLED ORANGES SHIPPED IN INITIALLY ICED CARS
(ITEM 295), VENTS CLOSED TO DESTINATION,
AND IN SIMILAR CARS HAVING VENTS
OPENED EN ROUTE

In shipping initially iced cars loaded with warm fruit to northern markets it is common practice to open the vents at some point en route, usually within 24 hours after icing.

It is reasonable to expect that the procedure that will give the most rapid drop in fruit temperature will also give the best control of decay.

In cold weather with shipments moving north into territory that ordinarily can be expected to become progressively cooler, no great advantage is likely to be gained by keeping the vents closed beyond the comparatively warm region in Florida and southern Georgia, and vents are therefore usually opened at Waycross or Savannah, Ga. In milder weather the vents probably should be kept closed longer -- until the outside temperature is lower than that in the car, or until ice meltage has advanced to the point where little if any refrigeration is derived from it. Just how far north this change should be made depends largely on the temperature of the fruit at time of loading and on weather conditions that may reasonably be anticipated.

Tests made during the 1938-39 season showed that during hot weather opening the vents in south Georgia was not as satisfactory as keeping them closed until the shipment reached Potomac Yards. With the results of these tests as a background, similar comparisons were made in April and again in May 1940 on shipments billed "vents closed to S. Rocky Mount, N. C.," for comparison with others billed "vents closed to destination."

In the test made during relatively cool weather in April it is interesting to note that there was a greater drop in fruit temperatures beyond S. Rocky Mount in the car with vents opened there than in the car with vents closed to destination. While the difference in fruit temperatures in the two cars was not great and no difference in the amount of decay was noted on arrival, more decay developed during the holding period in the test lots from the car with vents closed to destination than in those from the car that had vents opened to S. Rocky Mount. This difference in decay could hardly be attributed to differences in transit temperatures but might possibly have been due to a difference in humidity. A test made during warmer weather in May on shipments to Baltimore was conducted under weather conditions more favorable for bringing about differences in commodity temperature in cars handled as in the April test, but the differences were not as striking as would be expected in hot weather.

In the May test there was a gradual but steady drop in fruit temperature throughout the transit period in the car with vents closed to destination, and a comparable drop in the other car until the vents were opened at S. Rocky Mount, N. C. After opening the vents in the latter car the temperature of the bottom fruit rose rapidly.

The condition of the fruit noted on arrival at destination was approximately the same in both cars, but a week later considerably more decay had developed in the fruit from the car with vents opened at S. Rocky Mount.

These results again indicate that the point at which vents should be opened depends largely on weather conditions, which of course cannot be accurately anticipated at time of issuing billing instructions. During warm weather opening vents at S. Rocky Mount apparently was too soon, and better results probably would have been secured by leaving vents closed to Richmond or Potomac Yards. At best, however, the specification of a particular point at which vents are to be opened is something of a shot in the dark. The only reliable method of manipulating ventilation service is upon the basis of the difference in temperature inside and outside the car. When the outside air is cooler than the load vents should be opened; when it is warmer than the load vents should be closed. If cars were equipped with indicating thermometers, as are the refrigerator cars on Canadian lines, this type of service could be made reliable and satisfactory.

Commodity: Valencia oranges*

{ Loaded April 11, 1940
Date

Load: 420 Bruce boxes

{ Unloaded April 15, 1940

Loading point: Lake Alfred, Fla. Destination: New York, N.Y. CAR NO. FGE 50543

Service: Non precooled, initially iced with 8000 lbs. of ice after loading
(Item 295) plugs in vents closed to South Rocky Mount, open beyond.

Ice remaining at: Potomac Yards 1400 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 72° to 84°

Average 79° F.

Upon arrival:

	Top layer	Bottom layer
Doorway-centerline	50.0	37.0
Bunker-centerline	44.0	34.5

WEIGHT OF TEST CRATES

	Top Quarterlength	Bottom Quarterlength
<u>At time of loading</u>	96.5	97.0
<u>When unloaded</u>	94.3	95.2
<u>Loss of weight</u>	2.2 lbs.	1.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Fairly firm	Mostly fairly firm, few slightly soft
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	5
Withered at stem end	0	27
Stem-end rot	0	34
Penicillium rot	2	5
	<u>Top Ql.</u>	<u>Bot. Ql.</u>

* From frost damaged grove

TEST NO. 1940-3

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 400 Bruce boxes Date (Unloaded April 15, 1940
Loading point: Lucerne Park, Destination: Baltimore, Md. CAR NO. FGE 51337
Service: Non precooled, initially iced with 8000 lbs. of ice after loading
(Item 295) plugs in vents closed to Potomac Yards.

Ice remaining at: Potomac Yards 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 77° Average 73.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	49.0	40.0
Bunker-centerline	49.5	35.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	95.5	98.5
When unloaded	93.7	97.4
Loss of weight	1.8 lbs.	1.1 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity	
Stems	Fresh green	Some moldy	
General condition of fruit	Firm	Fairly firm	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	0	0	0
Aging	0	0	0
Withered at stem end	2	0	21
Stem-end rot	0	0	59
Penicillium rot	2	0	7

* From frost damaged grove

Commodity: Valencia oranges*

(Loaded May 4, 1940

Load: 402 Bruce boxes

Date(

(Unloaded May 8, 1940

Loading point: Lucerne Fl., Fla. Destination: Baltimore, Md. CAR NO. FGE 33462

Service: Non precooled, initially iced with 8000 lbs. ice after loading vents closed to S. Rocky Mount, N. C. -- opened beyond.

Ice remaining at: Destination 100 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 65° to 77° Average 69.3° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	65°	56°
Bunker-centerline	67°	56°

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
At time of packing 1/	95.5	94.5
When unloaded	94.0	91.7
Loss of weight	1.5 lbs.	2.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 70° F.; 85% relative humidity
--	----------------------	----------------------------------------------------------

Stems Mostly discolored and dry.
General condition of fruit Good

Mostly discolored and dry.
Generally in good condition
except soft.

	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	174	173	-----	-----
Pitting	0	0	0	0
Aging	0	0	1	0
Withered at stem end	16	6	32	27
Stem-end rot	0	0	39	27
Penicillium rot	2	0	4	3

* From frost damaged grove.

1/Packed May 3, 1940.

Commodity: Valencia oranges*

(Loaded May 4, 1940

Date(

(Unloaded May 8, 1940

Load: 402 Bruce boxes

Loading point: Lucerne Pt.Fla. Destination:Baltimore,Md CAR NO. TGE 15167

Service: Non precooled, initially iced with 8000 lbs. ice, vents closed to destination.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 65° to 70°

Average 66.8° F.

Upon arrival:

Doorway-centerline

Top layer
58-62

Bottom layer

Bunker-centerline

47-58

WEIGHT OF TEST CRATES

At time of packing

Top doorway Bottom bunker
94.3 95.4

When unloaded

92.3 94.4

Loss of weight

2.0 lbs. 1.0 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 7 days at 70° F.;
85% relative humidity

Stems

Fresh and green

Green but dry

General condition of fruit Good

Good except for wilting

Top dwy. Bot. bunk.

Top dwy. Bot. bunk.

Total fruits in test crate

173

173

Pitting

0

0

2

4

Aging

0

0

0

0

Withered at stem end

0

0

38

30

Stem-end rot

0

0

16

11

Panicillium rot

2

1

4

4

* From frost damaged grove

TEST NO. 1940-RS-5

COMPARISON OF RESULTS IN CARS OF ORANGES SHIPPED WITH ICE
PLACED IN THE UPPER HALF VS THE LOWER HALF OF THE BUNKER

Previous studies by the Department on shipments of citrus fruit from California to eastern markets as well as those made from Florida to northern markets last year have shown that placing ice, equal to one-half the bunker capacity, in the upper half of the bunker gave results comparable with those obtained when bunkers were iced to capacity. These studies have also shown that placing ice in the upper half bunker gave lower temperatures in transit than did placing the same amount of ice in the lower half.

It seemed desirable to conduct further tests along these lines under Florida conditions since the method might result in a saving to both shippers and carriers but the weather was cooler than normal and too cool for striking differences to show up in the results.

The tests made in May and June, 1939 when outside temperatures were relatively high indicated that (1) 4800 pounds of ice in the upper part of the bunker gave results comparable to 8000 pounds of ice placed on the grates in their normal position, (2) that slightly better results were obtained with 4000 pounds in the upper part of the bunker than with the same amount in the lower half, and that (3) during extremely hot weather a half bunker of ice was not sufficient to maintain desirable refrigeration to northern markets.

Four tests were made during the 1939-40 season to compare equal amounts of ice placed in the upper half of the bunker and in the lower half of the bunker. The first test was made in December, the second near the end of March, and the last two in May.

The results of these tests showed a somewhat greater ice meltage when the ice was placed in the upper half of the bunker than when it was placed in the lower half of the bunker. However, the increased meltage was not sufficient to materially lower the temperature of the commodity or affect its keeping quality.

Further tests should be conducted in warmer weather in order to more thoroughly evaluate the merits of this method of icing that has proved so satisfactory with transcontinental shipments made in warm weather.

Commodity: Pineapple oranges (Loaded Dec. 13, 1939
Load: 420 Bruce boxes Date (Unloaded Dec. 17, 1939
Loading point: Wintergarden, Destination: Chicago, Ill CAR NO. MTE 67009
Florida
Service: Precooled; initially iced by shipper, 4000 lbs. of ice in upper part
stage, after loading.

Ice remaining at: S. Louisville 1900 lbs. At destination 1700 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 32° to 40° Average 36° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	39.5	37.0
Bunker-centerline	39.0	40.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	93.0	95.0
<u>When unloaded</u>	91.2	94.2
<u>Loss of weight</u>	1.8 lbs.	0.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 8 days at 71° F.; 40% relative humidity
Stems	Dark and withered	Dark and withered
General condition of fruit	Firm	Mostly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216
Pitting	14	17
Aging	9	0
Withered at stem end	0	0
Stem-end rot	1	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216
Pitting	14	17
Aging	9	3
Withered at stem end	0	0
Stem-end rot	1	10
Penicillium rot	0	2

TEST NO. 1939-2

Commodity: Pineapple oranges

(Loaded Dec. 13, 1939

Date(

Load: 420 Bruce boxes

(Unloaded Dec. 17, 1939

Loading point: Wintergarden, Florida. Destination: Chicago, Ill. CAR NO. FGE 51410

Service: Precooled; initially iced by shipper, 4000 lbs. of ice in lower part stage, after loading.

Ice remaining at: S. Louisville 2200 lbs. At destination 2000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 34° to 35°

Average 38.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	44.0	38.0
Bunker-centerline	44.0	37.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	91.5	92.2
<u>When unloaded</u>	91.0	91.0
<u>Loss of weight</u>	0.5 lbs.	1.2 lbs.

SUMMARY OF INSPECTION NOTES

<u>When unloaded</u>	After holding 8 days at 71° F.; 40% relative humidity			
Stems	Dark and withered		Dark and withered	
General condition of fruit	Mostly firm		Only slight softening	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216	-----	-----
Pitting	10	13	31	39
Aging	0	0	13	8
Withered at stem end	0	0	0	0
Stem-end rot	0	0	9	11
Penicillium rot	0	0	0	0

TEST NO. 1939-2

Commodity: Valencia oranges (Loaded March 28, 1940
Load: 420 Bruce boxes Date (Unloaded April 1, 1940
Loading point: Wintergarden, Florida Destination: New York, N.Y. CAR NO. FGE 37865
Service: Precooled initially iced with 4800 lbs. of ice in upper part stage after loading plugs in vents closed to destination.

Ice remaining at: Hamlet 3800 lbs. at destination 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 36° to 43° Average 37.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	42.5	40.5
Bunker-centerline	43.5	36.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	99.8	95.2
<u>When unloaded</u>	99.3	94.3
<u>Loss of weight</u>	.5 lbs.	.9 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F. 60% relative humidity	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Stems	Green fresh	Half green, half gray	
General condition of fruit	Fairly firm	Many withered	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	----
Pitting	5	7	0 2
Aging	2	5	15 16
Withered at stem end	3	5	36 51
Stem-end rot	0	0	2 4
Penicillium rot	0	0	4 9

Commodity: Valencia oranges*

(Loaded March 28, 1940

Load: 420 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point: Wintergarden, Destination: New York, N.Y. CAR NO. FGE 37865
Florida

Service: Precooled initially iced with 4800 lbs. of ice in upper part stage
after loading plugs in vents closed to destination

Ice remaining at: Hamlet 3800 lbs. at destination 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 36° to 43° Average 37.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	42.5	40.5
Bunker-centerline	43.5	36.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	95.0	96.2
When unloaded	94.7	95.4
Loss of weight	0.3 lbs.	0.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green and fresh	Fresh and green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	2
Aging	0	0
Withered at stem end	0	2
Stem-end rot	0	0
Penicillium rot	1	3
	<u>Top Ql.</u>	<u>Bot. Ql.</u>

* From frost damaged grove

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Date(

(Unloaded April 1, 1940

Load: 420 Bruce boxes

Loading point: Wintergarden, Florida Destination: New York, N.Y. CAR NO. FGE 37256

Service: Precooled initially iced with 4800 lbs. of ice in lower part stage after loading (Item 295) plugs in vents closed to destination.

Ice remaining at: Hamlet 4200 lbs. at destination 2400 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 36° to 46° Average 40° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	42.5	40.5
Bunker-centerline	45.5	35.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.8	95.0
<u>When unloaded</u>	93.8	94.5
<u>Loss of weight</u>	1.0 lbs.	0.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 10 days at 70° F.; 60% relative humidity</u>
Stems	Fresh green	Mostly fresh green
General condition of fruit	Firm	Firm to fairly firm

	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	0	0	0	0
Aging	0	0	0	0
Withered at stem end	0	0	4	1
Stem-end rot	1	0	3	2
Penicillium rot	0	0	0	0

* From frost damaged grove.

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 420 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point: Wintergarden, Destination: New York, N.Y. CAR NO. FGE 37256
Fla.

Service: Precooled initially iced with 4800 lbs. of ice in lower part
stage after loading (Item 295) plugs in vents closed to destination.

Ice remaining at: Hamlet 4200 lbs. at destination 2400 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 36° to 46°

Average 40° F

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	42.5	40.5
Bunker-centerline	45.5	35.5

WEIGHT OF TEST CRATES.

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	97.8	96.7
<u>When unloaded</u>	97.3	95.3
<u>Loss of weight</u>	0.5 lbs.	1.4 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Half green, half gray.
General condition of fruit	Fairly firm	Many withered
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	3	9
Aging	3	6
Withered at stem end	3	6
Stem-end rot	0	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
-----	-----	-----
1	2	
16	18	
45	52	
2	3	
6	4	

* Frost free fruit

TEST NO. 1940-2

Commodity: Valencia oranges*

(Loaded May 9, 1940

Date(

(Unloaded May 13, 1940

Load: 420 Standard boxes

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 67824
Florida

Service: Precooled, initially iced with 4800 lbs. of ice in upper half of stage (Rule 295)

Ice remaining at: 350 lbs. at destination.

FRUIT TEMPERATURES

At time of loading:

Range 44° to 66° Average 54° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	54	53
Bunker-centerline	48	42

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	101.4	103.0
<u>When unloaded</u>	100.7	102.5
<u>Loss of weight</u>	.7 lbs.	.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 72° F.; 68% relative humidity	
Stems	Green and fresh	Fairly green and fresh	
General condition of fruit	Good	Good	
	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>
Total fruits in test crate	173	172	-----
Pitting	0	0	4
Aging	0	0	0
Withered at stem end	6	0	0
Stem-end rot	0	0	6
Penicillium rot	0	0	6

Commodity: Valencia oranges*

(Loaded May 9, 1940

Load: 420 standard boxes

Date(

(Unloaded May 13, 1940

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. EGE 37707
Florida

Service: Precooled, initially iced 4800 lbs. in bottom half stage after
loading (Item 295) vents closed to destination.

Ice remaining at: Destination 2600 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 37° to 46°

Average 42° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	51	----
Bunker-centerline	49	40

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	100.9	103.7
<u>When unloaded</u>	99.8	102.5
<u>Loss of weight</u>	1.1 lbs.	1.2 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 72° F.; 68% relative humidity	
Stems	Fresh and green	Fairly green and fresh	
General condition of fruit	Good	Good	
	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>
Total fruits in test crate	173	172	-----
Pitting	0	0	0
Aging	0	0	0
Withered at stem end	0	0	0
Stem-end rot	0	0	3
Penicillium rot	0	0	4

*From frost damaged grove

Commodity: Valencia oranges* (Loaded May 16, 1940
; ; Date (Unloaded May 21, 1940
Load: 420 Bruce boxes

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 37377
Florida

Service: Precooled, initially iced with 4800 lbs. of ice in lower part stage.
Iced after loading (Item 295) vents closed to destination.

Ice remaining at: Richmond 3200 lbs. at destination 2200 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 34° to 43° Average 37.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	46.0	44.0
Bunker-centerline	50.5	41.0

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	100.7	99.6
<u>When unloaded</u>	No weight in N.Y.	No weight in N.Y.
<u>Loss of weight</u>		

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 69° F.; 80% relative humidity		
Stems	-----	-----	-----	
General condition of fruit	-----	-----	-----	
	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate				
Pitting				
Aging				
Withered at stem end				
Stem-end rot				
Penicillium rot				
From frost damaged grove				
			TEST NO. 1940-4	

Commodity: Valencia oranges*

(Loaded May 16, 1940

Load: 420 Bruce boxes

Date(

(Unloaded May 20, 1940

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 37319
Florida

Service: Precooled, initially iced with 4800 lbs. of ice in upper part stage
iced after loading (Item 295) vents closed to destination

Ice remaining at: Richmond 2400 lbs. at destination 1500 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 32° to 40°

Average 37.8° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	47.5	44.0
Bunker-centerline	47.0	40.5

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	97.5	97.4
<u>When unloaded</u>	98.0	98.3
<u>Loss of weight</u>	.5 lbs. gain	.9 lbs. gain

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 69° F.; 80% relative humidity
Stems	Fresh and green	Somewhat brown and dry
General condition of fruit	Good	Good
	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	2
Withered at stem end	0	1
Stem-end rot	0	3
Penicillium rot	0	1

*From frost damaged grove

COMPARISON OF RESULTS IN CARS OF PRECOOLED FRUIT SHIPPED WITH PLUGS IN,
VENTS CLOSED (NO ICE) AND WITH HALF BUNKER ICING.

At three different times during the shipping season, in December, March and May, precooled oranges were shipped without ice in the bunkers for comparison with similarly precooled oranges shipped with about 1/2 tank of ice placed in the upper half of the bunkers after loading.

There was a more rapid rise of fruit temperatures in the cars without ice, especially in the top of the load. In May the temperature rise was so rapid in the car without ice that to protect the load 4800 pounds of ice was placed in the bunkers at Potomac Yards.

All lots arrived at market in sound condition but one week later there was significantly more decay in the lots which had been shipped without ice in the bunkers.

This is strong evidence that precooled fruit should be shipped under refrigeration if the fruit is likely to be held several days at room temperatures before it is consumed. Likewise, it seems essential to ship precooled fruit under refrigeration in warm weather regardless of the length of time it is to be held.

Commodity: Pineapple oranges (Loaded Dec. 13, 1939
Load: 420 Bruce boxes Date (Unloaded Dec. 17, 1939
Loading point: Plymouth, Fl. Destination: Chicago, Ill. CAR NO. FGE 37792
Service: Precooled, no ice in bunkers, vents closed to destination.

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading:

Range 30° to 42° Average 35° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	47.5	41.0
Bunker-centerline	44.5	41.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of packing</u>	94.0	96.0
<u>When unloaded</u>	94.0	95.2
<u>Loss of weight</u>	0.0 lbs.	0.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>		After holding 8 days at 71° F.; 40% relative humidity	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216	-----	-----
Pitting	13	16	43	39
Aging	0	0	5	9
Withered at stem end	0	0	0	0
Stem-end rot	0	0	8	20
Penicillium rot	0	0	1	0

TEST NO. 1939-2

Commodity: Pineapple oranges (Loaded Dec. 13, 1939
Load: 420 Bruce boxes Date (Unloaded Dec. 17, 1939
Loading point: Winter Garden, Destination: Chicago, Ill. CAR NO. WFE 67009
Florida
Service: Precooled; initially iced by shipper, 4000 lbs. of ice in upper part
stage, after loading.

Ice remaining at: S. Louisville 1900 lbs. At destination 1700 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 32° to 40° Average 36° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	39.5	37.0
Bunker-centerline	39.0	40.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	93.0	95.0
When unloaded	91.2	94.2
Loss of weight	1.8 lbs.	0.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 8 days at 71° F.; 40% relative humidity
Stems	Dark and withered	Dark and withered
General condition of fruit	Firm	Mostly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216
Pitting	14	17
Aging	0	0
Withered at stem end	0	0
Stem-end rot	1	0
Penicillium rot	0	0

Commodity: Valencia oranges*

(Loaded March 28, 1940

Load: 404 standard boxes

Date(

(Unloaded April 1, 1940

Loading point: Plymouth, Fla. Destination: New York, N.Y. CAR NO. EGE 37138

Service: Precooled, no ice in bunkers, plugs in vents closed to destination

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 32.5° to 34° Average 33.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	44.0
Bunker-centerline	50.5	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	95.2
<u>When unloaded</u>	95.8	94.5
<u>Loss of weight</u>	0.7 lbs.	0.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity		
Stems	Green fresh	Fresh green		
General condition of fruit	Firm	Firm to fairly firm		
	<u>Top Ql.</u> <u>Bot. Ql.</u>	<u>Top Ql.</u> <u>Bot. Ql.</u>		
Total fruits in test crate	176	176	-----	-----
Pitting	0	0	0	0
Aging	0	0	0	0
Withered at stem end	0	0	6	1
Stem-end rot	0	0	0	0
Penicillium rot	0	0	0	0

* From frost damaged grove

TEST NO. 1940-2

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 404 standard boxes

Date(

(Unloaded April 1, 1940

Loading point: Plymount, Fla. Destination: New York, N.Y. CAR NO. FGE 37138

Service: Precooled, no ice in bunkers, plugs in vents closed to destination

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 32.5° to 34°

Average 33.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	44.0
Bunker-centerline	50.5	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	98.0	97.8
<u>When unloaded</u>	97.3	97.2
<u>Loss of weight</u>	0.7 lbs.	0.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	3	6	3	2
Aging	0	0	11	16
Withered at stem end	0	0	15	29
Stem-end rot	2	0	20	2
Penicillium rot	0	0	14	15
* Frost free fruit			TEST NO. 1940-2	

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Date(

Load: 420 Bruce boxes

(Unloaded April 1, 1940

Loading point: Winter Garden, Destination: New York, N.Y. CAR NO. FGE 37865
Fla.

Service: Precooled initially iced with 4800 lbs. of ice in upper part stage
after loading plugs in vents closed to destination

Ice remaining at: Hamlet 3800 lbs. at destination 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 36° to 43°

Average 37.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	42.5	40.5
Bunker-centerline	43.5	36.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.0	96.2
<u>When unloaded</u>	94.7	95.4
<u>Loss of weight</u>	0.3 lbs.	0.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green and fresh	Fresh and green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	0	2
Aging	0	0
Withered at stem end	0	2
Stem-end rot	0	0
Pencillium rot	1	3

* From frost damaged grove

TEST NO. 1940-2

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 420 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point: Winter Garden, Destination: New York, N.Y. CAR NO. FGE 37865
Florida

Service: Precooled initially iced with 4800 lbs. of ice in upper part stage
after loading plugs in vents closed to destination.

Ice remaining at: Hamlet 3800 lbs. at destination 1900 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 36° to 43°

Average 37.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	42.5	40.5
Bunker-centerline	43.5	36.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	99.8	95.2
When unloaded	99.3	94.3
Loss of weight	.5 lbs.	.9 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Half green, half gray
General condition of fruit	Fairly firm	Many withered
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	5	7
Aging	2	5
Withered at stem end	3	5
Stem-end rot	0	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Frost free fruit	-----	-----
	0	2
	15	16
	36	51
	2	4
	4	9

TEST NO. 1940-2

Commodity: Valencia oranges*

(Loaded May 16, 1940

Load: 420 standard boxes

Date(

(Unloaded May 20, 1940

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 50805
Florida

Service: Bunkers dry vents closed** initially iced at Potomac Yards 4800 lbs.
of ice in upper part of stage, vents closed to destination.

Ice remaining at: At destination 2000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 29° to 45°

Average 35.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	53.5	43.5
Bunker-centerline	49.0	38.5

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	103.1	107.5
<u>When unloaded</u>	103.0	108.2
<u>Loss of weight</u>	0.1 lbs.	0.7 lbs. gain

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 7 days at 69° F.; 80% relative humidity</u>
Stems	Green and fresh	Somewhat brown and dry
General condition of fruit	Good	Good
	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	174	174
Pitting	0	0
Aging	0	0
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0

* From frost damaged grove

**Icing instructions; To be initially iced when
average temperature of top boxes of fruit reach 60° F.

TEST NO. 1940-4

Commodity: Valencia oranges*

(Loaded May 16, 1940

Load: 420 Bruce boxes

Date(

(Unloaded May 20, 1940

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 37319
Florida

Service: Precooled, initially iced with 4800 lbs. of ice in upper part stage
iced after loading (Item 295) vents closed to destination

Ice remaining at: Richmond, Va., 2400 lbs. at destination 1500 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 32° to 40° Average 37.8° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	47.5	44.0
Bunker-centerline	47.0	40.5

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	97.5	97.4
<u>When unloaded</u>	98.0	98.3
<u>Loss of weight</u>	.5 lbs. gain	.9 lbs. gain

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 69° F.; 80% relative humidity	
		<u>Top dwy.</u>	<u>Bot. bunk.</u>
Stems	Fresh and green		Somewhat brown and dry
General condition of fruit	Good		Good
Total fruits in test crate	176	176	-----
Pitting	0	0	0
Aging	0	0	2
Withered at stem end	0	0	1
Stem-end rot	0	0	3
Penicillium rot	0	0	1

* From frost damaged grove

COMPARISON OF RESULTS IN CARS OF PRECOOLED ORANGES SHIPPED WITH

8,000 POUNDS OF ICE IN BOTTOM OF BUNKER (ITEM 295)

AND WITH 4,800 POUNDS OF ICE IN UPPER HALF

OF BUNKER

A test was made in April with precooled oranges in which a comparison was made between a car initially iced with 8,000 pounds of ice and one with 4,800 pounds of ice in the upper half of the bunker.

The ice meltage during transit was about 1,000 pounds greater in the car initially iced with 8,000 pounds, but this was not enough to influence the temperature of the load significantly because commodity temperatures in transit were closely parallel in the two cars. There was no significant difference in the amount of decay. No decay developed in transit in either car, and a week later the decay was about the same in the two lots.

The results of this test, therefore, indicate that in the shipment of precooled oranges, use of 4,800 pounds of ice in the upper half of the bunker gave as good results as 8,000 pounds used in the ordinary way.

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 400 standard boxes

Date(

(Unloaded April 15, 1940

Loading point: Waverly, Fla. Destination: New York, N.Y. CAR NO. FGE 51238

Service: Precooled, initially iced with 4800 lbs. of ice upper part stage
(Item 295) plugs in vents closed to destination.

Ice remaining at: Potomac Yards 2000 lbs. At destination 1800.

FRUIT TEMPERATURES

At time of loading:

Range 37° to 50° Average 43° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	43.5	-----
Bunker-centerline	42.5	35.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	96.8
<u>When unloaded</u>	94.2	94.3
<u>Loss of weight</u>	2.3 lbs.	2.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.: 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Fairly firm	Fairly firm to slightly soft
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	7
Withered at stem end	0	25
Stem-end rot	0	13
Penicillium rot	0	1

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 400 standard boxes

Date (

(Unloaded April 15, 1940

Loading point: Waverly, Fla. Destination: New York, N.Y. CAR NO. FGE 51238

Service: Precooled, initially iced with 4800 lbs. of ice upper part stage
(Item 295)

Ice remaining at: Potomac Yards 2000 lbs. At destination 1800 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 37° to 50°

Average 43° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	43.5	-----
Bunker-centerline	42.5	35.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	100.0	104.0
<u>When unloaded</u>	105.1	102.0
<u>Loss of weight</u>	0.9 lbs.	2.0 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.: 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Fairly firm	Fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	0
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
	-----	-----
	1	0
	3	2
	0	3
	50	35
	2	2

* Frost free fruit

TEST NO. 1940-3

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 400 standard boxes

Date(

(Unloaded April 15, 1940

Loading point: Isleworth, Fla. Destination: New York, N.Y. CAR NO. FGE 50167

Service: Precooled. Item 295 (8000 lbs. ice after loading). Vents closed to destination

Ice remaining at: Potomac Yards 4400 lbs. At N. Y. unloading 4000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 43° - 54°

Average 45.8° F.

Upon arrival:

Doorway-centerline

Top layer
44.5°

Bottom layer
39.0°

Bunker-centerline

44.5°

35.5°

WEIGHT OF TEST CRATES

At time of loading

Top Ql.

Bottom Ql.

96.2

99.0

When unloaded

95.2

95.3

Loss of weight

1.0 lbs.

3.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° E; 65% relative humidity
Stems	Fresh and green	Mostly fresh and green
General condition of fruit		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	0
Withered at stem end	0	1
Stem-end rot	0	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
	-----	-----
	0	0
	5	6
	20	10
	18	12
	1	2

* From frost damaged grove

TEST NO. 1940-3

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 400 Standard boxes

Date (Unloaded April 15, 1940

Loading point: Isleworth, Fla. Destination: N. Y. City CAR NO. FGE 50167

Service: Precooled. Item 295 (8000 lbs. ice after loading). Vents closed to destination

Ice remaining at: Potomac Yards, 4,400 lbs. N. Y. unloading 4,000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 43° - 54°

Average 45.8° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	44.5°	39.0°
Bunker-centerline	44.5°	35.5°

WEIGHT OF TEST CRATES

	<u>Top Ql.</u>	<u>Bottom Ql.</u>
<u>At time of loading</u>	103.5	104.0
<u>When unloaded</u>	102.1	103.1
<u>Loss of weight</u>	1.4 lbs.	.9 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh and green	Mostly fresh and green
General condition of fruit		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	4
Withered at stem end	0	2
Stem-end rot	0	37
Penicillium rot	0	5

* Frost free fruit

COMPARISON OF RESULTS WITH PRECOOLED ORANGES SHIPPED IN CARS WITH
PLUGS IN, VENTS CLOSED, AND WITH NONPRECOOLED ORANGES
SHIPPED UNDER REFRIGERATION.

It has sometimes been questioned whether it pays to precool citrus fruit in Florida. In order to obtain further information on the subject four tests were conducted during the past season. Each test consisted of a comparison between one car of precooled oranges and one car of nonprecooled oranges shipped under refrigeration, either Rule 240 or Item 295.

The first test was made in November when a car of precooled oranges shipped under Item 295 (6,000 pounds of ice) was compared with a car of nonprecooled oranges shipped with the same quantity of ice in the bunkers. The car loaded with precooled fruit maintained lower temperatures throughout the transit period and developed less decay during the holding period of 1 week after arrival at destination.

The second test was made in January during a period of cold weather, when the outside temperature ranged from 14° to 32° F. In this test a car of precooled oranges without transit refrigeration was compared with a car of nonprecooled oranges forwarded under Item 295 (6,000 pounds of ice). The weather was cold in Florida on the day of loading so that the temperature of the nonprecooled fruit averaged 46° as compared with 40° for the precooled oranges. The weather became increasingly colder as the car moved north, and by the time the shipment reached Potomac Yards it was so cold that the ice was removed and two heaters were installed to keep the fruit from freezing. With so little difference in loading temperature and with cold weather all the way North, the test fruit in both cars arrived in about the same condition and held up about the same during the following week. There was no stem-end rot in either of the test lots and no significant difference in the amount of penicillium rot.

The third test was made in March when outside temperatures ranged between 48° and 83° F., mostly above 60° . In this test a car of precooled oranges without transit refrigeration was compared with a car of nonprecooled oranges under Item 295 (6,000 pounds of ice). The temperatures in transit were lower in the precooled load than in the nonprecooled, and as a consequence much less stem-end rot developed in the former during the holding period after arrival at destination.

The fourth test was conducted in May when the outside temperature was considerably warmer, ranging between 58° and 92° F. A car of precooled oranges averaging about 35° F. at time of loading was compared with a car of nonprecooled oranges averaging about 76° which was shipped under Item 295 (8,000 pounds of ice). Under these conditions

the temperature of the precooled load rose so rapidly that it seemed advisable to add 4,800 pounds of ice in the upper half of the bunker at Potomac Yards. This checked the rising temperature and maintained the temperature within a fairly satisfactory range for the remainder of the trip. Despite the rise in temperature in the precooled car, considerably more decay developed in the nonprecooled lot during the holding period.

Commodity: Hamlin oranges, gassed and color added (Loaded November 17, 1939
Load: 404 Bruce boxes Date (Unloaded November 20, 1939

Loading point: Orlando, Fla. Destination: New York, N.Y. CAR NO. FGE 21653

Service: Non precooled, initially iced with 8000 lbs. of ice after loading,
(Item 295) vents closed to Potomac Yards, open beyond

Ice remaining at: At destination 700 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 86° to 88° Average 86.5° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	60°	45°
Bunker-centerline	55°	40°

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	102.0	101.0
<u>When unloaded</u>	101.4	100.9
<u>Loss of weight</u>	.6 lbs.	0.1 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 65° F.; 37% relative humidity	
Stems	Mostly fresh and green	Moldy	
General condition of fruit	Normal	Less pitting than 1939-RS-1	
	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>
Total fruits in test crate	172	172	-----
Pitting	0	1	5
Aging	0	0	0
Withered at stem end	0	0	1
Stem-end rot	0	0	6
Penicillium rot	0	0	2

Commodity: Hamlin oranges, gassed and color added

(Loaded November 17, 1939
Date)

Load: 400 standard boxes

(Unloaded November 22, 1939)

Loading point: Isleworth, Fla. Destination: Springfield, CAR NO. FGE 10606
Mass.

Service: Precooled, initially iced with 8000 lbs. of ice, vents closed to Potomac Yards, open beyond.

Ice remaining at: No records.

FRUIT TEMPERATURES

At time of loading:

Range 41° to 45° Average 43.7° F.

Upon arrival

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	no record	no record
Bunker-centerline	" "	" "

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	102.1	100.2
<u>When unloaded</u>	101.4	100.8
<u>Loss of weight</u>	.7 lbs.	.6 lbs. gain

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 62° F.; 37% relative humidity
Stems	Mostly dark and wilted	Mostly dark and dry
General condition of fruit	Normal	More pitting than test 1939-RS-2

	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	172	172	-----	-----
Pitting	1	2	13	21
Aging	0	0	1	2
Withered at stem end	0	0	2	4
Stem-end rot	0	0	4	0
Penicillium rot	0	0	1	3

Commodity: Pineapple oranges (Loaded Jan. 25, 1940
Load: 400 standard boxes Date (Unloaded Jan. 29, 1940

Loading point: Maitland, Fla. Destination: New York, N.Y. CAR NO. FGE 36364

Service: Initially iced with 6000 lbs. of ice after loading (Item 295). Ice removed at Potomac Yards 2 heaters installed and lighted.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 43° to 50° Average 46° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	46.5	40
Bunker-centerline	48.0	39.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	98.0	100.6
<u>When unloaded</u>	98.0	No weight in N.Y.
<u>Loss of Weight</u>	.0 lbs.	

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 65° F.; 47% relative humidity	
		<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh and green		Fairly fresh and green
General condition of fruit	Firm		Generally firm; several fairly firm few withered
Total fruits in test crate	176	176	-----
Pitting	14	10	50
Aging	0	0	3
Withered at stem end	0	0	8
Stem-end rot	0	0	0
Penicillium rot	0	0	11

TEST NO. 1940-1

Commodity: Pineapple oranges

(Loaded January 25, 1940

Date(

Load: 400-1/2 standard boxes

(Unloaded January 29, 1940

Loading point: Isleworth, Fl. Destination: New York, N.Y., CAR NO. FGE 37705

Service: Precooled, no ice in bunkers, vents closed to destination.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 29° to 48°

Average 40.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	39.5	35.5
Bunker-centerline	39.5	37.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	No weight in Fla.	No weight in Fla.
<u>When unloaded</u>	101.6 lbs.	98.8 lbs.
<u>Loss of weight</u>		

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 65° F.; 47% relative humidity
Stems	Green--fresh	Fairly fresh---green
General condition of fruit	Firm	Generally firm, several fairly firm; occasionally withered.

	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	10	8	41	46
Aging	0	1	5	1
Withered at stem end	0	0	5	3
Stem-end rot	0	0	0	0
Penicillium rot	0	0	11	7

Commodity: Valencia oranges* (Loaded March 28, 1940
Load: 402 standard boxes Date (Unloaded April 2, 1940
Loading point: Lake Wales, Fla. Destination: New York, N.Y. CAR NO. FGE 37102
Service: Non precooled, 6000 lbs. ice after loading, plugs in vents closed to destination.

Ice remaining at: Hamlet 3400 lbs. at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 74° Average 72° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	64.5	54.0
Bunker-centerline	65.0	50.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	97.8	98.0
<u>When unloaded</u>	96.3	96.4
<u>Loss of weight</u>	1.5 lbs.	1.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Green fresh	Half green half gray
General condition of fruit	Firm to fairly firm	Mostly firm many slightly soft
Total fruits in test crate	176	-----
Pitting	5	5
Aging	13	31
Withered at stem end	12	14
Stem-end rot	0	37
Penicillium rot	9	29
	5	46

Commodity: Valencia oranges*

(Loaded March 28, 1940

Load: 402 standard boxes

Date(

(Unloaded April 2, 1940

Loading point: Lake Wales, Fla. Destination: New York, N.Y. CAR NO.: FGE 37102

Service: Non precooled, 6000 lbs. ice after loading, plugs in vents closed to destination.

Ice remaining at: Hamlet 3400 lbs. at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 74°

Average 72° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	64.5	54.0
Bunker-centerline	65.0	50.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.6	96.6
<u>When unloaded</u>	93.3	no weight N. Y.
<u>Loss of weight</u>	1.3 lbs.	

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Green fresh
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	0
Withered at stem end	0	4
Stem-end rot	2	12
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
-----	-----	-----
0	0	0
0	0	2
4	12	2
12	1	2

* From frost damaged grove.

Commodity: Valencia oranges*

(Loaded March 28, 1940)

Load: 404 standard boxes

Date(

(Unloaded April 1, 1940)

Loading point: Plymouth, Fla. Destination: New York, N.Y. CAR NO. FGE 37138

Service: Precooled, no ice in bunkers, plugs in vents closed to destination

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 32.5° to 34°

Average 33.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	44.0
Bunker-centerline	50.5	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	98.0	97.8
<u>When unloaded</u>	97.3	97.2
<u>Loss of weight</u>	0.7 lbs.	0.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Half green, half gray
General condition of fruit	Freshest of the	Freshest of the several frost free lots
several frost free lots		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	3	6
Aging	0	0
Withered at stem end	0	0
Stem-end rot	2	0
Penicillium rot	0	0

Frost free fruit

TEST NO. 1940-2

Commodity: Valencia oranges*

(Loaded March 28, 1940

Load: 404 standard boxes

Date _____

(Unloaded April 1, 1940

1 Loading point: Plymouth, Fla. Destination: New York, N.Y. CAR NO. FGE 37138

Service: Precooled, no ice in bunkers, plugs in vents closed to destination

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 32.5° to 34°

Average 33.4° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	44.0
Bunker-centerline	50.5	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	95.2
<u>When unloaded</u>	95.8	94.5
Loss of weight	0.7 lbs.	0.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity	
Stems	Green fresh	Fresh green	
General condition of fruit	Firm	Firm to fairly firm	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	0	0	0
Aging	0	0	0
Withered at stem end	0	0	6
Stem-end rot	0	0	0
Penicillium rot	0	0	0

* From frost damaged grove.

Commodity: Valencia oranges*

(Loaded May 16, 1940

Load: 402 Bruce boxes

Date(

(Unloaded May 20, 1940

Loading point: Lucerne Park Destination: Baltimore, Md. CAR NO. FGE 37414
Florida

Service: Non precooled, initially iced with 8000 lbs. of ice after loading
(Item 295) vents closed to Potomac Yards open beyond.

Ice remaining at: Richmond 2400 lbs. Potomac Yards 1800 lbs., Baltimore 125.

FRUIT TEMPERATURES

At time of loading:

Range 75° to 77°

Average 75.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	56	44
Bunker-centerline	-----	44

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
<u>At time of loading</u>	99.8	99.8
<u>When unloaded</u>	99.3	99.4
Loss of weight	0.5 lbs.	0.4 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 70° F.; 85% relative humidity
Stems	Fresh and green	Green but dried
General condition of fruit	Firm and good	Good
	<u>Top dwy.</u>	<u>Bot. bunk.</u>
Total fruits in test crate	175	176
Pitting	0	0
Aging	0	0
Withered at stem end	4	2
Stem-end rot	0	0
Penicillium rot	0	1
	<u>Top dwy.</u>	<u>Bot. bunk.</u>
-----	-----	-----

* From frost damaged grove

Commodity: Valencia oranges* (Loaded May 16, 1940
Load: 420 standard boxes Date (Unloaded May 20, 1940

Loading point: Florence Villa Destination: New York, N.Y. CAR NO.: FGE 50805
Florida

Service: Bunkers dry vents closed** initially iced at Potomac Yards 4800 lbs.
of ice in upper part of stage. Vents closed to destination.

Ice remaining at: Destination 2000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 29° to 45° Average 35.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	53.5	43.5
Bunker-centerline	49.0	38.5

WEIGHT OF TEST CRATES

	<u>Top doorway</u>	<u>Bottom bunker</u>
At time of loading	103.1	107.5
When unloaded	103.0	108.2
Loss of weight	0.1 lbs.	0.7 lbs. gain

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 69° F.; 80% relative humidity	
Stems	Green and fresh	Somewhat brown and dry	
General condition of fruit	Good	Good	
	<u>Top dwy.</u>	<u>Bot. bunk.</u>	<u>Top dwy.</u>
Total fruits in test crate	174	174	-----
Pitting	0	0	2
Aging	0	0	1
Withered at stem end	0	0	0
Stem-end rot	0	0	1
Penicillium rot	0	0	3

* From frost damaged grove

**Icing instructions; To be initially iced when
average temperature of top of box of fruit reach 60° F.

TEST NO. 1940-4

COMPARISON OF RESULTS IN CARS EQUIPPED WITH (1) CONVENTIONAL
END BUNKERS, (2) OVERHEAD BUNKERS, AND (3) DRY ICE SYSTEM
OF REFRIGERATION.

Refrigerator cars equipped with the conventional type end-bunkers have been in use for many years in the United States. In recent years refrigerator cars with bunkers the entire length of the car, located between the ceiling and the roof, have come into use, particularly in Canada. This type of car is so constructed that the cooled air and drip water pass down a metal lined duct in the sidewall.

In another type of car refrigeration (the Broquinda system) dry ice is used to cool a secondary refrigerant (a liquid having a low freezing point) which is circulated through coils on the side walls just below the ceiling. The flow of the liquid is thermostatically controlled so as to regulate the temperature within the car body. The dry ice is placed in bunkers, one at each end, extending down from the ceiling to about half the distance between floorrack and ceiling. The system is so arranged that the carbon dioxide gas from the sublimating dry ice can be vented as desired into the car body or out into the atmosphere. This car is designed to maintain low temperatures of chilled commodities such as frozen vegetables, meats, precooled fruits, etc., rather than to cool warm commodities.

These cars, representing each of the three types described above, were provided for test purposes. They had the same amount of insulation and were as nearly comparable as to insulation as could be obtained.

Three transportation test trips were made with these test cars loaded with citrus fruit from various points in Florida to northern markets. The three tests made on oranges were as follows: (1) non-precooled oranges loaded in pre-iced cars, not reiced in transit (Rule 240), (2) non-precooled oranges shipped under standard refrigeration and salt, and (3) precooled oranges, initially iced after loading with 8000 pounds of ice and not reiced in transit (Item 295).

In general the results of these three tests indicate that in non-precooled shipments in the end bunker car there was the greatest difference between the maximum and minimum fruit temperatures during transit and the least in the overhead bunker car. These differences ranged between 19° and 34° in the end bunker car, 8.0° and 17.0° in the dry ice car, and 4.0° and 19.0° in the overhead bunker car. In other words, the difference between the warmest and the coldest fruit in the car was generally greater in the end bunker car and least in the overhead bunker car.

The minimum temperatures in these cars were found at the following locations at the bottom bunker opening of the end bunker car; in the top layer next the sidewall of the dry ice car; and in the bottom layer

position at the doorway centerline of the overhead bunker car. The maximum temperatures in all these cars were generally found at the top layer quarterlength or doorway centerline positions.

The variable commodity temperatures at time of loading make it difficult to determine which of the three cars was most efficient in cooling the fruit in the top layer. With non-precooled shipments the dry ice system cooled the top layer the slowest, although there was but little difference between this car and the end bunker car in this respect. The data indicate that the overhead bunker car brought the temperatures down throughout the load at nearly the same rate, the same is likewise true of the dry-ice system but with the latter the rate was much slower, due, no doubt, to lack of sufficient cooling surface furnished by the coils. The end bunker car lowered the temperature of the bottom layer much faster than that of the top layer.

There was no great difference in the amount of decay that developed in the test fruit from these three test cars. This indicates that during the comparatively short haul from Florida to New York City or to Chicago, Ill. the differences in temperatures noted above had no marked influence on the condition of the fruit at time of unloading or after being held for several days at room temperature.

More tests should be made under various weather conditions and to more distant destinations before definite and dependable conclusions can be drawn as to the advantages and disadvantages of these three methods of refrigerating non-precooled oranges in transit.

Commodity: Pineapple oranges; gassed & color added (Loaded Dec. 13, 1939
Load: 424 Bruce and standard boxes Date (Unloaded Dec. 20, 1939
Loading point: Winter Garden, Destination: Chicago, Ill. CAR NO. FGE 51677
Florida (End Bunker)
Service: Non precooled, preiced with 9600 lbs. of ice (Rule 240)

Ice remaining at: S. Louisville 1000 lbs.; at destination 200 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 77° - 84° Average 80.3° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	54.5°	42.5°
Bunker-centerline	54.5°	41.0°

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom quarterlength</u>
<u>At time of loading</u>	95.2 lbs.	96.4 lbs.
<u>When unloaded</u>	93.2 "	94.7 "
<u>Loss of weight</u>	2.0 lbs.	1.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 71° F.; <u>40% relative humidity</u>
Stems	Dark and withered	Dark and withered
General condition of fruit	Firm to fairly firm.	Mostly soft
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216
Pitting	45	36
Aging	2	0
Withered at stem end	0	0
Stem-end rot	4	0
Penicillium rot	0	0

Commodity: Pineapple oranges; gassed & color added (Loaded Dec. 13, 1939
Date
Load: 420 Bruce boxes (Unloaded Dec. 18, 1939
Loading point: Fairvilla, Fla. Destination: Chicago, Ill. CAR NO. FGE 50214
(Broquinda)
Service: Non precooled, preiced with 2737 lbs. of dry ice.

Ice remaining at: S. Louisville 0 lbs.; at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 64° to 74° F. Average 69° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	59.0	52.5
Bunker-side	56.0	53.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	93.0 lbs.	91.0 lbs.
<u>When unloaded</u>	92.5 "	89.5 "
Loss of weight	0.5 lb.	1.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 8 days at 71° F.; 40% relative humidity
Stems	Dark and withered	Dark and withered
General condition of fruit	Firm	Only slightly soft
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	216	216
Pitting	23	18
Aging	0	0
Withered at stem end	0	0
Stem-end rot	2	0
Penicillium rot	0	0

Commodity: Pineapple oranges; gassed & color added (Loaded Dec. 13, 1939
Date
Load: 420 Bruce boxes (Unloaded Dec. 19, 1939
Loading point: Auburndale, Fla. Destination:Chicago, Ill. CAR NO. CN 209511
(Overhead Bunker)
Service: Non precooled preiced with 6500 lbs. of ice plus 5% salt (Rule 240)

Ice remaining at: S. Louisville 0 lbs. At destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 58° to 75° Average 67.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	55.5	54.0
Bunker-side	56.5	55.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	93.0 lbs.	93.5 lbs.
When unloaded	92.0 "	87.2 "
Loss of weight	1.0	6.3 *

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 71° F.; 40% relative humidity	
Stems	Dark and withered	Dark and withered	
General condition of fruit	Firm to fairly firm	Mostly soft	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Total fruits in test crate	216	216	-----
Pitting	56	47	31
Aging	0	0	1
Withered at stem end	0	0	0
Stem-end rot	5	1	102
Penicillium rot	0	0	74
			1
			0

* Apparently some fruit removed after inspection but before weighing.

Commodity: Valencia oranges*

(Loaded March 28, 1940

Load: 630 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 51677
(End Bunker)

Service: Non precooled standard refrigeration plus salt; initially iced before loading

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 69° to 70°

Average 69.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	32.5
Bunker-centerline	50.5	31.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.5	94.4
<u>When unloaded</u>	93.9	94.3
<u>Loss of weight</u>	1.6 lbs.	0.1 lbs.

SUMMARY OF INSPECTION NOTES

<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity			
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh, green		Fresh green	
General condition of fruit	Fairly firm		Few wilted	
Total fruits in test crate	176	176	-----	-----
Pitting	0	0	2	1
Aging	0	0	0	0
Withered at stem end	1	0	8	9
Stem-end rot	0	0	0	0
Penicillium rot	1	0	2	2

* From frost damaged grove

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Date(

Load: 630 Bruce boxes

(Unloaded April 1, 1940

Loading point:Auburndale, Fla. Destination: New York,N.Y. CAR NO. FGE 51677

(End Bunker)

Service: Non precooled standard refrigeration plus salt; initially iced before loading.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 69° to 70°

Average 69.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	32.5
Bunker-centerline	50.5	31.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	99.3	95.2
<u>When unloaded</u>	98.4	94.5
<u>Loss of weight</u>	.9 lbs.	.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Fresh green	Half green, half gray
General condition of fruit	Dull; few wilted.	Many badly wilted and aged
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	6	1
Aging	4	0
Withered at stem end	12	11
Stem-end rot	0	0
Penicillium rot	6	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
-----	-----	-----

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 663 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point:Auburndale, Fla. Destination:New York, N.Y. CAR NO. FGE 50214

(Broquinda)

Service: Non precooled initially iced with 4158 lbs. dry ice after loading

Ice remaining at: Destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 68° to 72°

Average 70° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	63.0	53.5
Quarterlength side	62.5	51.5
Under bunker	63.0	56.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.5	97.4
<u>When unloaded</u>	93.6	96.7
<u>Loss of weight</u>	.9 lbs.	.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>		
<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	1	1	1
Aging	0	0	0
Withered at stem end	0	0	0
Stem-end rot	0	2	6
Penicillium rot	1	0	2

* From frost damaged grove

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 756 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point:Auburndale, Fla. Destination: New York, N.Y. CAR NO. CN 209511
(Overhead Bunker)

Service: Non precooled standard refrigeration plus salt initially iced after loading

Ice remaining at: Destination 1000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 67° to 80° Average 71° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	38.5
Quarterline side	48.0	41.5
Under bunker	49.5	42.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.4	95.0
<u>When unloaded</u>	94.5	93.6
<u>Loss of weight</u>	0.9 lbs.	1.4 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Fresh green	Fairly fresh, green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	1	3
Aging	0	1
Withered at stem end	0	1
Stem-end rot	1	3
Penicillium rot	2	4
		1

* From frost damaged grove

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 630 Bruce boxes Date (Unloaded April 15, 1940
Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 51677
Florida (End Bunker)
Service: Precooled, initially iced with 8000 lbs. of ice after loading (Item 295)
plugs in vents closed to destination.

Ice remaining at: Potomac Yards 5000 lbs. At destination 4400 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 31° to 45° Average 39° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	43.5	37.0
Bunker-centerline	43.5	34.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	97.8
<u>When unloaded</u>	94.1	95.2
<u>Loss of weight</u>	2.4 lbs.	2.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	2	0
Aging	0	1
Withered at stem end	0	0
Stem-end rot	0	1
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
	-----	-----

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

(Unloaded April 15, 1940

Load: 663 Bruce boxes

Loading point: Florence Villa, Destination: New York, N.Y. CAR NO. FGE 50214
Fla.

(Broquinda)

Service: Precooled, initially iced with 600 lbs. of dry ice after loading.

Plugs in vents closed to destination.

Ice remaining at: Destination 15 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 34° to 52°

Average 44° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	46.0
Bunker-centerline	50.5	50.5
Side quarterlength	50.5	47.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	94.8	96.5
When unloaded	94.3	95.0
Loss of weight	0.5 lbs.	1.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>		
<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	0	1	0
Aging	0	0	5
Withered at stem end	0	1	18
Stem-end rot	0	0	14
Penicillium rot	0	0	4

* From frost damaged grove

TEST NO. 1940-3

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

Load: 756 Bruce boxes

(Unloaded April 15, 1940

Loading point: Florence Villa, Destination: New York, N.Y. CAR NO. CN 209511
Florida

(Overhead Bunker)

Service: Precooled initially iced with 6400 lbs. of ice after loading (Item 295)
vents closed to destination.

Ice remaining at: Potomac Yards 4200 lbs. At destination 2000 lbs.

At time of loading:

Range 32° to 50°

Average 41.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	47.0	42.0
Bunker-centerline	----	----
Side quarterlength	45.0	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
At time of loading	96.5	96.5
When unloaded	94.4	95.1
Loss of weight	2.1 lbs.	1.4 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 65% relative humidity		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh green		Mostly fresh green	
General condition of fruit	Firm to fairly firm		Firm to fairly firm	
Total fruits in test crate	176	176	-----	-----
Pitting	0	0	1	1
Aging	0	0	2	4
Withered at stem end	0	2	26	20
Stem-end rot	0	0	15	7
Penicillium rot	0	0	2	2

* From frost damaged grove

COMPARISON OF RESULTS IN HEAVY AND STANDARD LOADS

Increasing the number of packages loaded in a refrigerator car has in some instances brought a reduction in freight rates as well as in refrigeration costs and has effected other savings to both shippers and carriers. An effort was made in this investigation to determine whether heavier loading might be feasible with oranges and especially to learn whether increasing the load from 4 layers high to 6 layers high would have an adverse effect on the condition of the fruit on arrival and after subsequent holding, and on the breakage or crushing of the bottom layer boxes.

Two tests, one with precooled oranges and one with non-precooled oranges, were made to obtain information on these points. The end bunker car contained 630 Bruce boxes, the dry ice car contained 663 Bruce boxes, while the overhead bunker car contained 756 Bruce boxes. Since the standard load is about 420 Bruce boxes there was thus an increase of approximately 38 and 50 percent in the respective loads.

The first test was made the last week in March and the second about the middle of April, both with Valencia oranges. The crates were well filled and were loaded on their sides in the usual manner.

Several boxes from the commercial load, in addition to the test packages, were examined at time of unloading, special attention being given to the bottom layer of each car. The test packages were reexamined a week after unloading, corresponding to the time ordinarily required for the fruit to be sold and pass through the consumers hands.

There was little difference in the appearance or keeping quality of the fruit from the various parts of the load. The bottom layer boxes were intact and showed no breakage or crushing. Photographs taken during unloading in each of the three heavily loaded cars are found in Figure 2 and show that the loads were intact with no breakage or crushing of the bottom layer. The results of these limited tests indicate, therefore, that it is entirely feasible to use the heavier load under such conditions as obtained in these tests. However, further tests should be made with more tender varieties and possibly with heavier packs before drawing final conclusions as to the advisability of increasing the minimum weight requirement generally.

Commodity: Valencia Oranges

(Loaded March 28, 1940

Date(

Load: 630 Bruce boxes

(Unloaded April 1, 1940

Loading point:Auburndale, Fla. Destination:New York, N.Y. CAR NO. FGE 51677
(End Bunker)

Service: Non precooled standard refrigeration plus salt; initially iced before loading.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 69° to 70°

Average 69.7° F.

Upon arrival:

Doorway-centerline

Top layer
50.0

Bottom layer
32.5

Bunker-centerline

50.5

31.

WEIGHT OF TEST CRATES

At time of loading

Top Quarterlength

Bottom Quarterlength

99.3

95.2

When unloaded

98.4

94.5

Loss of weight

.9 lbs.

.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh green	Half green, half gray		
General condition of fruit	Dull; few wilted.	Many badly withered and aged		
Total fruits in test crate	176	176	-----	-----
Pitting	6	1	1	10
Aging	4	0	15	47
Withered at stem end	12	11	30	39
Stem-end rot	0	0	27	11
Penicillium rot	6	0	33	11

Commodity: Valencia Oranges* (Loaded March 28, 1940
Load: 630 Bruce boxes Date (Unloaded April 1, 1940
Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 51677
Service: Non precooled standard refrigeration plus salt; initially iced
(End bunker)
before loading

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 69° to 70° Average 69.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	32.5
Bunker-centerline	50.5	31.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.5	94.4
<u>When unloaded</u>	93.9	94.3
<u>Loss of weight</u>	1.6 lbs.	0.1 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity	
		<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh, green	Fresh green	
General condition of fruit	Fairly firm	Few wilted	
Total fruits in test crate	176	176	-----
Pitting	0	0	2
Aging	0	0	0
Withered at stem end	1	0	8
Stem-end rot	0	0	0
Penicillium rot	1	0	2

*From frost damaged grove

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Date(

Load: 663 Bruce boxes

(Unloaded April 1, 1940

Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 50214

(Broquinda)

Service: Non precooled initially iced with 4158 lbs. dry ice after loading

Ice remaining at: Destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 68° to 72°

Average 70° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	63.0	53.5
Quarterlength side	62.5	51.5
Under bunker	63.0	56.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.5	97.4
<u>When unloaded</u>	93.6	96.7
<u>Loss of weight</u>	.9 lbs.	.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Mostly green fresh, some dry
General condition of fruit	Firm	Firm to fairly firm

	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	1	1	1	2
Aging	0	0	0	2
Withered at stem end	0	0	0	6
Stem-end rot	0	2	6	5
Penicillium rot	1	0	2	2

*From frost damaged grove

TEST NO. 1940-2

Commodity: Valencia Oranges* (Loaded March 28, 1940
Load: 756 Bruce boxes Date ((Unloaded April 1, 1940
Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. CN 209511
(Overhead Bunker)
Service: Non precooled standard refrigeration plus salt initially iced after loading

Ice remaining at: Destination 1000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 67° to 80° Average 71° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	38.5
Quarterline side	48.0	41.5
Under Bunker	49.5	42.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.4	95.0
<u>When unloaded</u>	94.5	93.6
<u>Loss of weight</u>	0.9 lbs.	1.4 lbs.

SUMMARY OF INSPECTION NOTES

<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh green	Fairly fresh, green
General condition of fruit	Firm	Firm to fairly firm
Total fruits in test crate	176	176
Pitting	1	1
Aging	0	0
Withered at stem end	0	1
Stem-end rot	1	0
Penicillium rot	2	0

* From frost damaged grove

Commodity: Valencia oranges*

(Loaded April 11, 1940

Load: 630 Bruce boxes

Date(

(Unloaded April 15, 1940

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 51677
Florida (End Bunker)

Service: Precooled, initially iced with 8000 lbs. of ice after loading (Item 295)
plugs in vents closed to destination.

Ice remaining at: Potomac Yards 5000 lbs. At destination 4400 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 31° to 45°

Average 39° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	43.5	37.0
Bunker-centerline	43.5	34.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	97.8
<u>When unloaded</u>	94.1	95.2
<u>Loss of weight</u>	2.4 lbs.	2.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	2	1
Aging	0	5
Withered at stem end	0	12
Stem-end rot	0	12
Penicillium rot	0	3
		11

*From frost damaged grove

TEST NO. 1940-3

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

(Unloaded April 15, 1940

Load: 663 Bruce boxes

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 50214
Fla.

(Broquinda)

Service: Precooled, initially iced with 600 lbs. of dry ice.
plugs in vents closed to destination.

Ice remaining at: destination 15 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 34° to 52°

Average 44° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	46.0
Bunker-centerline	50.5	50.5
Side quarterlength	50.5	47.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.8	96.5
<u>When unloaded</u>	94.3	95.0
<u>Loss of weight</u>	0.5 lbs.	1.5 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	1
Aging	0	0
Withered at stem end	0	1
Stem-end rot	0	0
Penicillium rot	0	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
-----	-----	-----
	0	1
	5	12
	18	31
	14	4
	4	1

* From frost damaged grove

TEST NO. 1940-3

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 756 Bruce boxes Date (Unloaded April 15, 1940
Loading point: Florence Villa Destination: New York, N.Y. CAR NO. CN 209511
Service: Precooled initially iced with 6400 lbs. of ice after loading (Item 295)
vents closed to destination. (Overhead bunker)

Ice remaining at: Potomac Yards 4200 lbs. At destination 2000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 32° to 50°

Average 41.1° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	47.0	42.0
Bunker-centerline	----	----
Side quarterlength	45.0	44.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5 lbs.	96.5 lbs.
<u>When unloaded</u>	94.4 "	95.1 "
<u>Loss of weight</u>	2.1 "	1.4 "

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	0	1
Aging	0	2
Withered at stem end	0	26
Stem-end rot	0	15
Penicillium rot	0	2

*From frost damaged grove

INFLUENCE OF CARBON DIOXIDE GAS ON ORANGES IN TRANSIT

Carbon dioxide gas (obtained from sublimating dry ice) is known to furnish a rapid method of retarding softening and decay of certain fruits. Brooks, Bratley, and McColloch¹ report that 2 or 3 days' exposure to concentrations of carbon dioxide gas varying from 60 percent to 30 percent had no injurious effect on the flavor or appearance of oranges but delayed the development of stem-end rot and penicillium rot for 12 to 48 hours.

The influence of carbon dioxide gas treatments on oranges in transit was studied in three tests; for purposes of comparison, shipments were included that received no treatment with the gas. The first test was made in January with nonprecooled fruit, the gas being obtained from 190 pounds of dry ice placed in the bunkers (half in each bunker) on top of the water-ice after the car was loaded. The concentration of gas in this car reached a maximum of 3 percent shortly after loading but by the time of arrival at Potomac Yards it had dropped to less than 1 percent. The fruit in this car was compared with that in a similar car which had no dry ice but was otherwise refrigerated the same.

There was about 10° difference between fruit temperature in the two cars at time of arrival, but no decay in either car at that time, and the penicillium rot that developed during the holding period of one week was probably caused by bruises or rough handling before shipment rather than by transit conditions.

The second test was made the latter part of March with a special refrigerator car equipped with the Broquinda system of refrigeration which uses dry ice as a refrigerant. This car is so arranged that part or all of the gas can be released into the car or vented to the outside. In this test, part of the gas was released in the body of the car, and the concentration was kept above 20 percent during the entire trip. Comparison was made between non-precooled fruit in this car and similar fruit in a comparable insulated end bunker car handled in the conventional way with water-ice only for cooling.

The third test was with the same car described in the second test and was conducted in the same way except that the fruit was precooled. The gas concentration was above 20 percent only as far as Savannah, Ga. beyond which it was reduced to between 5 percent and 10 percent for the rest of the trip.

There were no differences in the appearance or condition of the fruit in any of the tests that could be attributed to carbon dioxide gas. The flavor of the fruit was not affected in either the first test or the third test but in the second test there was a slight carbonated or off-flavor at time of unloading. However, this disappeared within a short time, and therefore probably was due to the high concentration of gas present at time of unloading, a condition

found only in this one test.

There was so significant difference in the amount of decay on arrival or after holding 7 to 10 days, in the test fruit from the cars supplied with carbon dioxide gas and the check cars which had no gas treatment en route.

The results of these tests on oranges are of special interest in view of the fact that carbon dioxide has been proved to retard or control some decay organisms. However orange shippers, especially in California, have been afraid to use gas treatments because of possible injurious effects on the fruit. Although no particularly beneficial results were secured in these tests it was demonstrated that the fruit was not adversely affected by rather high concentrations of the gas during the transit period from Florida to New York.

Commodity: Pineapple oranges

(Loaded January 25, 1940

Load: 400 standard boxes

Date(

(Unloaded January 29, 1940

Loading point: Maitland, Fla. Destination: New York, N.Y. CAR NO.: FGE 36364

Service: Initially iced with 6000 lbs. of ice after loading (Item 295). Ice removed at Potomac Yards 2 heaters installed and lighted.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 43° to 50°

Average 46° F.

Upon arrival:

Doorway-centerline

Top layer

46.5

Bottom layer

40

Bunker-centerline

48.0

39.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	98.0	100.6 lbs.
<u>When unloaded</u>	98.0	-----
<u>Loss of weight</u>	0	lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 65° F.; 47% relative humidity
Stems	Fresh and green	Fairly fresh and green
General condition of fruit	Firm	Generally firm; several fairly firm few withered
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	14	10
Aging	0	0
Withered at stem end	0	0
Stem-end rot	0	0
Penicillium rot	0	0
		11
		6

Commodity: Pineapple oranges (Loaded January 25, 1940

Date(

Load: 400 standard boxes (Unloaded January 30, 1940

Loading point: Maitland, Fla. Destination: New York, N.Y. CAR NO. FGE 36405

Service: Non precooled initially iced with 6000 lbs. of ice plus 190 lbs. dry ice in bunkers. Ice removed at Potomac Yards, 2 heaters installed and lighted

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 45° to 51°

Average 47° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	57	43.5
Bunker-centerline	60.5	51.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	102.6	100.4
<u>When unloaded</u>	102.6	100.2
<u>Loss of weight</u>	0.0 lbs.	0.2 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 65° F.; 47% relative humidity		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Green and fresh		Fairly fresh and green	
General condition of fruit	Firm		Generally firm. Several fruits fairly firm; few withered	
Total fruits in test crate	176	176	-----	-----
Pitting	10	13	25	56
Aging	0	0	5	5
Withered at stem end	0	0	4	3
Stem-end rot	0	0	0	0
Penicillium rot	0	0	10	7

TEST NO. 1940-1

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 630 Bruce boxes.

Date(

(Unloaded April 1, 1940

Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 51677

Service: Non precooled standard refrigeration plus salt; initially iced before loading

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 69° to 70° Average 69.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	32.5
Bunker-centerline	50.5	31.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.5	94.4
<u>When unloaded</u>	93.9	94.3
<u>Loss of weight</u>	1.6 lbs.	0.1 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Fresh, green	Fresh green
General condition of fruit	Fairly firm	Few wilted
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	0
Withered at stem end	1	0
Stem-end rot	0	0
Penicillium rot	1	0
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
-----	-----	-----
2	1	
0	0	
8	9	
0	0	
2	2	

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 630 Bruce-boxes

Date (Unloaded April 1, 1940

Loading point: Auburndale, Fla. Destination: New York, N.Y. CAR NO. FGE 51677

Service: Non precooled standard refrigeration plus salt; initially iced before loading.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 69° to 70°

Average 69.7° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	32.5
Bunker-centerline	50.5	31.

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	99.3	95.2
<u>When unloaded</u>	98.4	94.5
<u>Loss of weight</u>	.9 lbs.	.7 lbs.

SUMMARY OF INSPECTION NOTES

Stems
General condition of fruit

When unloaded
Fresh green
Dull; few wilted

After holding 10 days at 70° F.
60% relative humidity
Half green, half gray
Many badly withered and aged

Total fruits in test crate
Pitting
Aging
Withered at stem end
Stem-end rot
Penicillium rot

	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	-----	-----
Pitting	6	1	1	10
Aging	4	0	15	47
Withered at stem end	12	11	30	39
Stem-end rot	0	0	27	11
Penicillium rot	6	0	33	11

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 663 Bruce boxes

Date(

(Unloaded April 1, 1940

Loading point:Auburndale, Fla. Destination:New York, N.Y. CAR NO. FGE 50214

Service: Non precooled initially iced with 4158 lbs. dry ice after loading.

Ice remaining at: Destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 68° to 72°

Average 70° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	63.0	53.5
Quarterlength side	62.5	51.5
Under bunker	63.0	56.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.5	97.4
<u>When unloaded</u>	93.6	96.7
<u>Loss of weight</u>	.9 lbs.	.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Mostly green fresh, some dry
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	-----
Pitting	1	1
Aging	0	0
Withered at stem end	0	0
Stem-end rot	0	6
Penicillium rot	1	2

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

(Unloaded April 15, 1940

Load: 630 Bruce boxes

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 51677
Florida

Service: precooled, initially iced with 8000 lbs. of ice after loading (Item 295)
plugs in vents closed to destination.

Ice remaining at: Potomac Yards 5000 lbs. At destination 440 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 31° to 45°

Average 39° F.

Upon arrival:

Doorway-centerline

Top layer
43.5

Bottom layer
37.0

Bunker-centerline

43.5

34.0

WEIGHT OF TEST CRATES

At time of loading

Top Quarterlength

Bottom Quarterlength

96.5

97.8

When unloaded

94.1

95.2

Loss of weight

2.4 lbs.

2.6 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 10 days at 69° F.;
65% relative humidity

Stems

Fresh green

Mostly fresh green

General condition of fruit

Firm

Firm to fairly firm

Top Ql. Bot. Ql.

Top Ql. Bot. Ql.

Total fruits in test crate

176

176

Pitting

2

0

1

1

Aging

0

1

5

9

Withered at stem end

0

0

12

30

Stem-end rot

0

1

12

8

Penicillium rot

0

0

3

11

Commodity: Valencia oranges*

Loaded April 11, 1940

Date (

(Unloaded April 15, 1940

Load: 663 Bruce boxes

Loading point: Florence Villa Destination: New York, N.Y. CAR NO. FGE 50214
Fla. (Broquinda)

Service: Precooled, initially iced with 600 lbs. of dry ice.
plugs in vents closed to destination.

Ice remaining at: Destination 15 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 34° to 52°

Average 44° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	50.0	46.0
Bunker-centerline	50.5	50.5
Side quarterlength	50.5	47.0

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.8	96.5
<u>When unloaded</u>	<u>94.3</u>	<u>95.0</u>
<u>Loss of weight</u>	0.5 lbs.	1.5 lbs.

SUMMARY OF INSPECTION NOTES

* From frost damaged grove

COMPARISON OF RESULTS IN STANDARD END BUNKER CAR AND A
SIMILAR CAR EQUIPPED WITH MOVABLE PARTITIONS.

There has been some interest in a type of refrigerator car which would accommodate more than one lot of fruit in order to take care of smaller markets or of 2 or more dealers in the same or nearby markets. An overhead bunker, two compartment, 4-door car is being considered for this service on the Pacific Coast. In the 1940 tests from Florida it was decided to determine whether an ordinary end bunker car could be adapted to the purpose by use of movable screen-bulkheads, which could be locked in place wherever desired in the loading space. Such an arrangement had already been worked out by the Fruit Growers Express Co. and a car thus equipped was used in 2 tests in comparison with a standard car. The specially equipped car contained 2 movable bulkheads so that it was divided into 3 compartments (of equal size in these tests) but the aggregate load was equal to a standard carload. The partition was constructed of heavy mesh wire screen and was rigidly supported by a frame locked in place to the walls of the car. With this arrangement little effect on the temperature of the load attributable to the partitions was anticipated. In the first test conducted in March the cars were loaded with non-precooled fruit and were initially iced with 6000 pounds of ice after loading. The second test conducted in April was with precooled fruit, the cars being initially iced with 8000 pounds of ice after loading.

As could be anticipated from the nature and arrangement of the partitions, there was no significant difference between the transit temperatures in the 2 cars in either test or in the condition of the fruit upon arrival or after holding. It appears, therefore, that if there is a demand for facilities for less than carload lots the movable screen-bulkhead arrangement used in these tests can be utilized and that 2 or 5 lots of fruit can be carried thus in one car as satisfactorily as an entire carload in the same type of car.

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 403 standard boxes

Date (Unloaded April 1, 1940

Loading point: Lake Wales, Fla. Destination: New York, N.Y. CAR NO. NX 1913

Service: Non precooled initially iced 6000 lbs. ice after loading (Item 295)
plugs in vents closed to destination.

Ice remaining at: Hamlet 3300 lbs. at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 72° to 79° Average 75° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	65.0	50.5
Bunker-centerline	66.5	50.

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	95.1	95.3
<u>When unloaded</u>	93.6	94.1
<u>Loss of weight</u>	1.5 lbs.	1.2 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	<u>After holding 10 days at 70° F.; 60% relative humidity</u>		
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176	----	----
Pitting	0	2	0	0
Aging	0	0	0	3
Withered at stem end	0	0	7	10
Stem-end rot	0	0	11	4
Penicillium rot	0	0	0	2

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Date(

Load: 402 standard boxes

(Unloaded April 2, 1940

Loading point: Lake Wales, Fla. Destination: New York, N.Y. CAR NO. FGE 37102

Service: Non precooled, 6000 lbs. ice after loading, plugs in vents closed to destination.

Ice remaining at: Hamlet 3400 lbs. at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 74°

Average 72° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	64.5	54.0
Bunker-centerline	65.0	50.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	94.6	96.6
<u>When unloaded</u>	93.3	no weight N. Y.
<u>Loss of weight</u>	1.3 lbs.	

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity
Stems	Green fresh	Green fresh
General condition of fruit	Firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	0
Aging	0	0
Withered at stem end	0	4
Stem-end rot	2	12
Penicillium rot	0	0
	-----	-----
	0	0
	0	2
	4	2
	12	1
	0	2

* From frost damaged grove.

Commodity: Valencia Oranges*

(Loaded March 28, 1940

Load: 402 standard boxes

Date(

(Unloaded April 2, 1940

Loading point: Lake Wales, Fla. Destination: New York, N.Y. CAR NO. FGE 37102

Service: Non precooled, 6000 lbs. ice after loading, plugs in vents closed to destination.

Ice remaining at: Hamlet 3400 lbs. at destination 0 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 71° to 74°

Average 72° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	64.5	54.0
Bunker-centerline	65.0	50.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	97.8	98.0
<u>When unloaded</u>	96.3	96.4
<u>Loss of weight</u>	1.5 lbs.	1.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 70° F.; 60% relative humidity	
Stems	Green fresh	Half green half gray	
General condition of fruit	Firm to fairly firm	Mostly firm many slightly soft	
	<u>Top Ql.</u>	<u>Bot. Ql.</u>	<u>Top Ql.</u>
Total fruits in test crate	176	176	-----
Pitting	5	8	5
Aging	13	18	31
Withered at stem end	12	16	14
Stem-end rot	0	0	37
Penicillium rot	9	5	29
			46

* Frost free fruit

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

Load: 400 standard boxes

(Unloaded April 15, 1940

Loading point: Isleworth, Fla. Destination: New York, N.Y. CAR NO. NX 1913

Service: Precooled, 8000 lbs. of ice after loading (Item 295) plugs in vents closed to destination

Ice remaining at: Potomac Yards 4600 lbs. At destination 4400 lbs.

FRUIT TEMPERATURES

At time of loading

Range 39° to 52°

Average 42.8° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	45.5	38.0
Bunker-centerline	46.0	35.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.5	96.0
<u>When unloaded</u>	96.0	95.3
<u>Loss of weight</u>	.5 lbs.	0.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity
Stems	Fresh green	Mostly fresh green
General condition of fruit	Firm to fairly firm	Firm to fairly firm
	<u>Top Ql.</u>	<u>Bot. Ql.</u>
Total fruits in test crate	176	176
Pitting	0	1
Aging	0	1
Withered at stem end	0	21
Stem-end rot	0	13
Penicillium rot	0	2
		4
		3
		53
		8
		4

* From frost damaged grove

Commodity: Valencia oranges*

(Loaded April 11, 1940

Date(

(Unloaded April 15, 1940

Load: 400 standard boxes

Loading point: Isleworth, Fla. Destination: New York, N.Y. CAR NO. FGE 50167

Service: Precooled 8000 lbs. of ice after loading (Item 295) plugs in vents closed to destination.

Ice remaining at: 4400 lbs. at Potomac Yards. At destination 4000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 43° to 54°

Average 45.8° F.

Upon arrival:

Doorway-centerline

Top layer

44.5

Bottom layer

39

Bunker-centerline

44.5

35.5

WEIGHT OF TEST CRATES

At time of loading

Top Quarterlength

103.5

Bottom Quarterlength

104.0

When unloaded

102.1

103.1

Loss of weight

1.4 lbs.

.9 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 10 days at 69° F.;
65% relative humidity

Stems

Fresh green

Mostly fresh green

General condition of fruit

Fairly firm

Fairly firm, few slightly soft

Top Ql. Bot. Ql.

Top Ql. Bot. Ql.

Total fruits in test crate

176 176

Pitting

0 0

0 0

Aging

0 0

4 1

Withered at stem end

0 0

2 0

Stem-end rot

0 0

37 34

Penicillium rot

0 0

5 4

* Frost free fruit

TEST NO. 1940-3

Commodity: Valencia oranges* (Loaded April 11, 1940
Load: 400 standard boxes Date((Unloaded April 15, 1940

Loading point: Isleworth, Fla. Destination: New York, N.Y. CAR NO. FGE 50167

Service: Precooled 8000 lbs. of ice after loading (Item 295) plugs in vents closed to destination.

Ice remaining at: 4400 at Potomac Yards. At destination 4000 lbs.

FRUIT TEMPERATURES

At time of loading:

Range 43° to 54° Average 45.8° F.

Upon arrival:

	<u>Top layer</u>	<u>Bottom layer</u>
Doorway-centerline	44.5	39
Bunker-centerline	44.5	35.5

WEIGHT OF TEST CRATES

	<u>Top Quarterlength</u>	<u>Bottom Quarterlength</u>
<u>At time of loading</u>	96.2	99.0
<u>When unloaded</u>	95.2	95.3
<u>Loss of weight</u> .	1.0 lbs.	3.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 10 days at 69° F.; 65% relative humidity	
		<u>Top Ql.</u>	<u>Bot. Ql.</u>
Stems	Fresh green		
General condition of fruit	Fairly firm		
Total fruits in test crate	176	176	-----
Pitting	0	0	0
Aging	0	0	5
Withered at stem end	0	1	20
Stem-end rot	0	0	18
Penicillium rot	0	0	1
			2

* From frost damaged grove

TRANSPORTATION OF CITRUS FRUIT BY BOAT

A considerable proportion of the Florida citrus crop that moves to seaboard markets is transported by boat from Tampa, Fort Pierce, and Jacksonville.

The fruit is often held in shipside precooling or cold holding rooms for varying lengths of time between sailings. Some of the ships in Florida service have nonrefrigerated chambers equipped with a forced-ventilation system. All of them are equipped for refrigeration service adequate for maintaining low temperatures if the fruit is at such temperatures at time of loading, but not adequate for the rapid removal of field heat from warm fruit.

Shipping tests were made with Pineapple and Valencia oranges from Tampa and Fort Pierce to New York City during November, December, January, and April. The value of refrigeration service at shipside, as well as on the boats, was demonstrated repeatedly by the better condition on arrival and better keeping quality on the market of fruit held in "cold-hold" rooms pending arrival of the boats, and then carried under refrigeration in transit, as compared with fruit held at ordinary temperature and shipped by boat under ventilation.

Commodity: Pineapple oranges, gassed and color (Loaded Nov. 30, 1939.
added. Grove: A Date (Packed Nov. 29, 1939 (Unloaded Dec. 6, 1939.

Load:

Loading point: Tampa, Fla. Destination: N.Y., N.Y. SS COLORADO

Service: Precooled 12 hrs. and shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 31° to 36° F.

Average 33.4° F.

Upon arrival: No record

WEIGHT OF TEST CRATES

At time of packing 101.3 lbs.

When unloaded 100.1 "

Loss of weight 1.2 "

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 7 days at 68° F.;
45% relative humidity

Stems Mostly gray and wilted.
General condition of fruit Too deep color

Dark and dry.
Rind apparently injured by
processing.

Total fruits in test crate 172

Pitting 10

Aging 0

Withered at stem end 0

Stem-end rot 0

Penicillium rot 0

35

15

22

1

2

TEST NO. 1939-BS-1

I

- 125 -

Commodity: Pineapple oranges, gassed and (Loaded Dec. 4, 1939
color added. Grove: A Date (Packed Nov. 29, 1939 (Unloaded Dec. 10, 1939

Load:

Loading point: Tampa, Fla. Destination: N.Y., N.Y. SS CARTAGO

Service: Precooled 124 hrs. in "cold hold" room and shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: No record

Range	Average	°F.
-------	---------	-----

Upon arrival: 40° F.

WEIGHT OF TEST CRATES

At time of packing 103.0

When unloaded 101.9

Loss of weight 1.1 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded After holding 7 days at 67° F.;
48% relative humidity

Stems	Gray and wilted	Black and dry
General condition of fruit	Too deep color.	Rind apparently injured by processing.

Total fruits in test crate	108
Pitting	14
Aging	2
Withered at stem end	1
Stem-end rot	0
Penicillium rot	0

TEST NO. 1939-BS-2

Commodity: Pineapple oranges, gassed and color (Loaded Dec. 7, 1939.
added. Grove: A Date (Packed Nov. 29, 1939 (Unloaded Dec. 13, 1939.
Load:

Loading point: Tampa, Fla. Destination: New York, SS ALAMO
N.Y.

Service: In open shed 18 hrs.; in precooler 7 days; and shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 38° to 58° F. Average 50.6° F.

Upon arrival: Average 37° F.

WEIGHT OF TEST CRATES

<u>At time of loading</u>	101.7
<u>When unloaded</u>	99.1
<u>Loss of weight</u>	2.6 lbs.

SUMMARY OF INSPECTION NOTES

<u>When unloaded</u>	After holding 7 days at 67° F.; 48% relative humidity
Stems Dry and gray.	Dry and dark.
General condition of fruit Too deep color.	Fruit apparently injured by processing.

Total fruits in test crate	170	-----
Pitting	11	32
Aging	0	28
Withered at stem end	0	5
Stem-end rot	0	0
Penicillium rot	1	4

Commodity: Pineapple oranges, gassed. Grove B (Loaded December 7, 1939
Packed Dec. 7, 1939 Date (Unloaded December 13, 1939
Load: Chamber only partly filled
Loading point: Tampa, Fla. Destination: New York, N.Y. SS ALAMO
Service: Precooled 3-1/4 hrs. and shipped under refrigeration

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 38° - 58° F. Average 50.6° F.

Upon arrival: Average 45° F.

WEIGHT OF TEST CRATES

<u>At time of loading</u>	103.8
<u>When unloaded</u>	102.8
<u>Loss of weight</u>	1.0 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 7 days at 67° F.;
48% relative humidity

Stems	Dry and dark	Dry and dark, many falling out.
General condition of fruit	Firm to fairly firm	Slightly soft

Total fruits in test crate	171	-----
Pitting	7	34
Aging	7	10
Withered at stem end	0	42
Stem-end rot	0	5
Penicillium rot	1	7

Commodity: Pineapple oranges, gassed
Grove: B
Packed Dec. 7, 1939

(Loaded December 7, 1939
Date (Unloaded December 13, 1939

Load: Test box in non refrigerated chamber

Loading point: Tampa, Fla. Destination: New York, N.Y. SS ALAMO

Service: Non precooled, shipped under ventilation (a service not offered from Tampa to New York.)

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: Average 67° F.

Upon arrival: Average 55° F.

WEIGHT OF TEST CRATES

<u>At time of loading</u>	100.0
<u>When unloaded</u>	97.2
<u>Loss of weight</u>	2.8 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 67° F.; <u>48%</u> relative humidity
Stems	Dry and dark	Dry and dark, many falling out
General condition of fruit	Firm to fairly firm	Soft
Total fruits in test crate	172	-----
Pitting	22	26
Aging	0	20
Withered at stem end	4	32
Stem-end rot	4	46
Penicillium rot	1	1

Commodity: Pineapple oranges, gassed (Loaded December 11, 1939
Grove B Date (Unloaded December 17, 1939
Packed Dec. 7, 1939

Load: Chamber fairly well filled

Loading point: Tampa, Fla. Destination: New York, N.Y. SS PARISMINA

Service: Precooled and shipped under refrigeration. (In cold hold room 105 hrs., stowed in refrigerated hold.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: Average 32° F.

Upon arrival: Average 38° F.

WEIGHT OF TEST CRATES

At time of loading 99.1

When unloaded 97.8

Loss of weight 1.3 lbs.

SUMMARY OF INSPECTION NOTES

		After holding 7 days at 65° F.; <u>44% relative humidity</u>
Stems	Dark and gray	Dark and gray
General condition of fruit	Firm to fairly firm	Firm to fairly firm
Total fruits in test crate	170	
Pitting	16	42
Aging	2	54
Withered at stem end	0	25
Stem-end rot	0	2
Penicillium rot	0	1

Commodity: Pineapple oranges. Grove: C (Loaded Jan. 10, 1940
Packed Jan. 9, 1940 Date
Load: Chamber fairly well filled (Unloaded Jan. 14, 1940

Loading point: Fort Pierce, Destination: New York, N.Y. SS ELIZABETH
Florida

Service: Precooled 20 hrs. in cold hold room and shipped under refrigeration

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: Average 43° F.

Upon arrival: Average 37° F.

WEIGHT OF TEST CRATES

At time of loading 101.0

When unloaded 100.8

Loss of weight .2 lbs.

SUMMARY OF INSPECTION NOTES

		After holding 7 days at 64° F.; 46% relative humidity
<u>When unloaded</u>		
Stems	Green and fresh	Gray and dry
General condition of fruit	Good	Good to fairly good
Total fruits in test crate	172	-----
Pitting	38	60
Aging	0	4
Withered at stem end	0	5
Stem-end rot	0	4
Penicillium rot	1	3

Commodity: Pineapple orangees. Grove: C (Loaded January 19, 1940
Packed Jan. 9, 1940 Date (Unloaded January 14, 1940
Load:

Loading point: Fort Pierce, Destination: New York, N.Y. SS ELIZABETH
Florida

Service: Non precooled, shipped under forced ventilation.

Ice remaining at: -----

FRUIT TEMPERATURES

At time of loading: Average 62° F.

Upon arrival: Average 45° F.

WEIGHT OF TEST CRATES

At time of loading 105.5

When unloaded 104.7

Loss of weight .8 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded

Stems Green and fresh
General condition of fruit Good

After holding 7 days at 64° F.;
46% relative humidity

Total fruits in test crate	172	-----
Pitting	74	69
Aging	0	9
Withered at stem end	0	2
Stem-end rot	0	13
Penicillium rot	5	13

Gray and dry
Good to fairly good

Commodity: Pineapple oranges. Grove: D (Loaded Jan. 17, 1940
Packed Jan. 13, 1940 Date (Unloaded Jan. 21, 1940)
Load:

Loading point: Ft. Pierce, Fla. Destination: N.Y., N.Y. SS HILTON

Service: Precooled 98 hrs. in "cold hold" room and shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 34° to 55° F. Average 47.5° F.

Upon arrival: Average 43° F

WEIGHT OF TEST CRATES

At time of packing 102.0 lbs.

When unloaded 100.9 "

Loss of weight 1.1 "

SUMMARY OF INSPECTION NOTES

<u>When unloaded</u>	<u>After holding 7 days at 63° F.; 40% relative humidity</u>
Stems Green and fresh	Gray and dry
General condition of fruit Very good	Good
Total fruits in test crate 170	
Pitting 5	17
Aging 0	3
Withered at stem end 1	12
Stem-end rot 0	2
Penicillium rot 0	13

Commodity: Pineapple oranges. Grove:D (Loaded Jan. 17, 1940
Packed Jan. 13, 1940 Date (Load: (Unloaded Jan. 21, 1940

Loading point: Ft. Pierce, Fla. Destination: N.Y., N.Y. SS HILTON

Service: Non precooled (held in packing house 96 hrs.); shipped under forced ventilation.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: Average 74° F.

Upon arrival: Average 44° - 49° F. (ship's record)

WEIGHT OF TEST CRATES

At time of packing 102.5 lbs.

When unloaded 100.8

Loss of weight 1.7 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 63° F.; 40% relative humidity
Stems	Green and fresh.	Gray and dry.
General condition of fruit	Good.	Not as good as lot IX.
Total fruits in test crate	172	
Pitting	7	27
Aging	0	7
Withered at stem end	0	12
Stem-end rot	0	20
Penicillium rot	6	8

Commodity: Pineapple oranges. Grove: E. (Loaded Jan. 17, 1940.
Packed Jan 16, 1940 Date (Load: (Unloaded Jan. 21, 1940.

Loading point: Ft. Pierce, Fla. Destination: New York, N.Y. SS HILTON

Service: precooled 26 hrs. in "cold hold" room and shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: Average 36° F.

Range	Average	°F.
Upon arrival:	Average	42° F.

WEIGHT OF TEST CRATES

<u>At time of packing</u>	104.0
<u>When unloaded</u>	103.4
<u>Loss of weight</u>	.6 lbs.

SUMMARY OF INSPECTION NOTES

	<u>When unloaded</u>	After holding 7 days at 63° F.; 40% relative humidity
Stems	Green and fresh	Fairly fresh and green
General condition of fruit	Very good	Good
Total fruits in test crate	171	-----
Pitting	10	54
Aging	0	8
Withered at stem end	0	9
Stem-end rot	1	3
Penicillium rot	0	10

Commodity: Pineapple oranges. Grove: E (Loaded Jan. 17, 1940
Packed Jan. 16, 1940 Date (Unloaded Jan. 21, 1940
Load: (Unloaded Jan. 21, 1940
Loading point: Ft. Pierce, Fla. Destination: N.Y., N.Y. SS HILTON
Service: Non precooled (held in packing house 26 hrs.) and shipped under forced ventilation.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading: Average 60° F.

Range	Average	°F.
-------	---------	-----

Upon arrival: Average 50° F.

WEIGHT OF TEST CRATES

At time of packing 104.4 lbs.

When unloaded 102.9

Loss of weight 1.5 lbs.

SUMMARY OF INSPECTION NOTES

When unloaded

After holding 7 days at 63° F.;
40% relative humidity

Stems Green and fresh
General condition of fruit Good

Fairly fresh and green
Not as good as lot XI

Total fruits in test crate	172
Pitting	0
Aging	53
Withered at stem end	1
Stem-end rot	1
Penicillium	7

7
71
8
2
36

Commodity: Valencia oranges*. Grove F (Loaded April 3, 1940
Packed April 2, 1940 Date(Load: Chamber filled with fruit (Unloaded April 7, 1940

Loading point: Fort Pierce, Destination: New York, N.Y. SS ELIZABETH
Florida

Service: Precooled 24 hrs. in cold hold room and shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 35° to 36° Average 35-1/2° F.

Upon arrival: Average 42° F.

WEIGHT OF TEST CRATES

At time of packing** 103.2

When unloaded 102.9

Loss of weight .3 lbs.

SUMMARY OF INSPECTION NOTES

		After holding 7 days at 69° F.; 60% relative humidity
	<u>When unloaded</u>	
Stems	Green and fresh	Mostly fresh and green
General condition of fruit	Good	Good
Total fruits in test crate	175	-----
Pitting	0	1
Aging	0	11
Withered at stem end	0	11
Stem-end rot	0	5
Penicillium rot	0	1

** Packed April 2, 1940

* From frost damaged grove

TEST NO. 1940-BS-7

Commodity: Valencia oranges*. Grove: F (Loaded April 3, 1940
Packed April 2, 1940 Date
Load: Chamber filled with fruit (Unloaded April 7, 1940
Loading point: Fort Pierce, Fla. Destination: New York, N.Y. SS ELIZABETH
Service: Non precooled, shipped under refrigeration.

Ice remaining at:

FRUIT TEMPERATURES

At time of loading:

Range 55° to 65° Average 60° F.

Upon arrival: Average 43°

WEIGHT OF TEST CRATES

At time of packing** 101.5

When unloaded 101.8

Loss of weight .3 lbs. gain

SUMMARY OF INSPECTION NOTES

When unloaded

Stems Green and fresh
General condition of fruit Good

After holding 7 days at 69° F.;
60% relative humidity

Mostly fresh and green
Noticeably less fresh than lot
1940-BS-7

Total fruits in test crate	175
Pitting	0
Aging	0
Withered at stem end	0
Stem-end rot	0
Penicillium rot	1

1
14
18
13
10

* From frost damaged grove

** Packed April 2, 1940

LOSS IN WEIGHT OF FLORIDA ORANGES IN TRANSIT

During the investigations covered by this report weights were obtained at loading point and at destination, for 108 test boxes of oranges. From these weights the percentage of loss in weight in transit was calculated for each box and for all the boxes, grouped in three different ways. The results of these calculations are given in the table below:

Ventilated	-	1.53 percent	Nonventilated	-	1.16 percent
Frost-free	-	1.14	Frost-damaged grove	-	1.35
Precooled	-	1.12	Nonprecooled	-	1.36
<hr/> <u>Average of all - 1.30 percent</u>					

It will be noted that the average loss for all boxes is 1.3 percent and that the differences found in all three groups are small. The greatest difference--0.37 percent--is between boxes from ventilated and from non-ventilated cars and even this is so small as to be of no commercial significance.

It should be remembered that the figures shown above are for a transit period of four days during which the fruit was shut up in a refrigerator car. The loss in weight would undoubtedly be more rapid after the fruit is removed from the car and also during any subsequent holding period, either in the hands of the wholesaler or in a retail store.

SUMMARY AND GENERAL OBSERVATIONS

During the present season studies were conducted on a total of 51 carloads of Florida citrus fruit forwarded by rail and 14 carloads by boat.

The results show that with the fast train and boat service now in effect the fruit ordinarily is not in transit long enough to develop serious losses from decay or other spoilage, and usually arrives in New York in sound condition even when not refrigerated in transit. However, the results also show that during the succeeding week, which covers the period ordinarily required for the fruit to be sold and consumed, decay is likely to develop in a large part of a nonrefrigerated shipment, especially late in the season and during hot weather. It is believed that the conditions noted after the holding tests influence ultimate market reaction to Florida citrus fruit more than do the results found upon arrival, although the latter doubtless influence the wholesale trade to the most marked extent.

It was found that there was a general correlation between the temperature of the fruit while in transit and the decay which developed after arrival. Non precooled fruit shipped under ventilation or under initial icing (Item 295 or Rule 240) generally showed poorer condition, more signs of aging, and heavier decay than comparable fruit that had been precooled, whether the latter was shipped in dry cars with plugs in and vents closed or under initial icing.

The results showed that precooled fruit could be shipped satisfactorily during cold or cool weather without ice with plugs in and vents closed, but that during hot weather transit refrigeration was desirable.

Fruit shipped under refrigeration usually presented the best appearance on the market, the rind being firm and the stems fresh and green. This advantage persisted during the holding period, and spoilage losses were also less in the refrigerated fruit.

Standard ventilation was fairly satisfactory during cold weather, but it is bound to give varying and uncertain results due to varying weather conditions. Decay was generally higher in the fruit from ventilated cars than in that shipped under refrigeration.

Overhead ventilation, accomplished by closing the bottom bunker opening and forcing the incoming air over the top of the load, did not give as good results as standard ventilation. This is at variance with the results on California shipments and points to the difference in the conditions that are met in shipping fruit from these two localities.

Changing from some other type of service to ventilation service at some station en route, and the use of ventilation service in general, cannot be made to give dependable and satisfactory results unless it is based upon the difference in temperature inside and outside the car. When the outside air is cooler than the load there will be benefits from opening the vents; when it is warmer than the load the vents should be kept closed. If refrigerator cars were equipped with indicating thermometers, as are the latest Canadian cars, this method could be employed, and ventilation service could be made more reliable and satisfactory than it is now.

In comparing the results obtained with part-stage initial icing -- 4,000 to 4,800 pounds of ice in the upper half of the bunker with a similar quantity in the lower half or with icing according to Item 295 (8000 pounds of ice)--no significant difference was found this year, whereas in the 1938-39 season better results were obtained with upper half-stage icing. In this connection, however, it should be kept in mind that the tests this season were made during cold weather, whereas last year the weather was warmer when the comparisons were made, and the differences in results were correspondingly more pronounced.

In comparing the transit refrigeration of oranges shipped in the three special cars used in the 1939-40 tests, the results indicate that the dry-ice refrigerating system (Broquinda) did not have sufficient coil surface to adequately cool a warm load. The overhead-bunker car cooled the load most uniformly. The end-bunker car cooled some parts of the load to the lowest temperature, but the top layer was not cooled as much as in the overhead-bunker car. In the overhead-bunker car as high as 15 percent salt was used without causing freezing of nonpre-cooled oranges, whereas in the end-bunker car 5 percent salt gave dangerously low temperatures and had to be decreased to 3 percent under the same weather conditions.

When loaded to capacity the overhead-bunker car held 756 Bruce boxes, the Broquinda-equipped car 663, and the standard end-bunker car 630. These heavy loads arrived in good condition, without breakage or shifting, and without any excess bruising or other injurious effect on the fruit. If tariff charges make it advantageous to use such heavy loads, further tests should be made on the more tender varieties and possibly with heavier bulge packs, which are sometimes used.

The results of tests with the carbon dioxide treatment of oranges in transit showed that the concentration used had no particularly harmful effect on the market condition of the fruit; neither was there any beneficial effect, doubtless because the gas was not used in high enough concentration (except in one test, when the check fruit, as well as the gas-treated fruit, failed to develop more than a small percentage of decay during the holding period after arrival at market).

It was found that there was no significant difference between

fruit shipped in a car with two movable screen-bulkheads and that shipped in a car without such bulkheads. In other words, it appears that by using movable screen-bulkheads, 2 or 3 lots of fruit can be carried in one car as satisfactorily as an entire carload in the same car.

The results with fruit shipped by boat in nonrefrigerated chambers were similar to those obtained in similar rail tests. The fruit did not hold up as well after delivery as that which was shipped under refrigeration. This was true whether the fruit was warm when loaded or had been through the "cold-hold" rooms of shipside precooling plants.

Loss in weight of oranges in the test boxes during transit from Florida to northern markets was so small as to be of no commercial importance. This was true, whether the comparison was made between ventilated and nonventilated fruit, frost-free fruit and fruit from frost-damaged groves, precooled and nonprecooled fruit, or fruit shipped in either Bruce boxes or standard boxes.

Somewhat surprising results were found in comparing frost-damaged with non-frost-damaged fruit shipped after the January freeze. In all cases the fruit that showed more or less frost injury remained in better condition during transit and the subsequent holding period than the non-frost-injured fruit. While it must be kept in mind that the two kinds were never strictly comparable, having come from different groves in different localities, and presumably were subjected to different growing conditions, the results show that the frost-injured fruit which can be shipped under present regulations governing the marketing of such fruit stood up satisfactorily.

